Kawasaki

JET SKI® watercraft

ULTRA 250X

JET SKI® Watercraft Service Manual

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This quick reference guide will assist you in locating a desired topic or procedure.

- Bend the pages back to match the black tab of the desired chapter number with the black tab on the edge at each table of contents page.
- Refer to the sectional table of contents for the exact pages to locate the specific topic required.

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The right is reserved to make changes at any time without prior notice and without incurring an obligation to make such changes to products manufactured previously. See your JET SKI® watercraft dealer for the latest information on product improvements incorporated after this publication.

All information contained in this publication is based on the latest product information available at the time of publication. Illustrations and photographs in this publication are intended for reference use only and may not depict actual model component parts.

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LIST OF ABBREVIATIONS

A	ampere(s)	lb	pound(s)
ABDC	after bottom dead center	m	meter(s)
AC	alternating current	min	minute(s)
ATDC	after top dead center	N	newton(s)
BBDC	before bottom dead center	Pa	pascal(s)
BDC	bottom dead center	PS	horsepower
BTDC	before top dead center	psi	pound(s) per square inch
°C	degree(s) Celsius	r	revolution
DC	direct current	rpm	revolution(s) perminute
F	farad(s)	TDC	top dead center
°F	degree(s) Fahrenheit	TIR	total indicator reading
ft	foot, feet	V	volt(s)
g	gram(s)	W	watt(s)
h	hour(s)	Ω	ohm(s)
L	liter(s)		

COUNTRY AND AREA CODES

AT	Austria	EUR	Europe
CA	Canada	GB	United Kingdom
CAL	California	US	United States
CH	Switzerland	WVTA	Whole Vehicle Type Approval
DE	Germany		

MAINTENANCE AND ADJUSTMENTS

Maintenance, replacement, or repair of the emission control devices and systems may be performed by any marine SI engine repair establishment or individual.

EMISSION CONTROL INFORMATION

Fuel Information

THIS ENGINE IS CERTIFIED TO OPERATE ON UNLEADED PREMIUM GRADE GASOLINE ONLY.

A minimum of 90 octane of the antiknock index is recommended. The antiknock index is posted on service station pumps.

Emission Control Information

To protect the environment in which we all live, Kawasaki has incorporated an exhaust emission control system in compliance with applicable regulations of the United States Environmental Protection Agency.

Exhaust Emission Control System

This system reduces the amount of pollutants discharged into the atmosphere by the exhaust of this engine. The fuel, ignition and exhaust systems of this engine have been carefully designed and constructed to ensure an efficient engine with low exhaust pollutant levels.

Maintenance

Proper maintenance and repair are necessary to ensure that watercraft will continue to have low emission levels. This Service Manual contains those maintenance and repair recommendations for this engine. Those items identified by the Periodic Maintenance Chart are necessary to ensure compliance with the applicable standards.

Tampering with Emission Control System Prohibited

Federal law prohibits the following acts or the causing thereof: (1) the removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new engine for the purposes of emission control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the engine after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed below:

Do not tamper with the original emission related parts.

* Digital Transistor Ignition System
* Fuel Pump
* Spark Plugs
* Throttle Body and Internal Parts
* Fuel Injectors
* ECU
* Supercharger with intercooler & relief-valves

Foreword

This manual is designed primarily for use by trained mechanics in a properly equipped shop. However, it contains enough detail and basic information to make it useful to the owner who desires to perform his own basic maintenance and repair work. A basic knowledge of mechanics, the proper use of tools, and workshop procedures must be understood in order to carry out maintenance and repair satisfactorily. Whenever the owner has insufficient experience or doubts his ability to do the work, all adjustments, maintenance, and repair should be carried out only by qualified mechanics.

In order to perform the work efficiently and to avoid costly mistakes, read the text, thoroughly familiarize yourself with the procedures before starting work, and then do the work carefully in a clean area. Whenever special tools or equipment are specified, do not use makeshift tools or equipment. Precision measurements can only be made if the proper instruments are used, and the use of substitute tools may adversely affect safe operation.

For the duration of the warranty period, we recommend that all repairs and scheduled maintenance be performed in accordance with this service manual. Any owner maintenance or repair procedure not performed in accordance with this manual may void the warranty.

To get the longest life out of your JET SKI® watercraft:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki JET SKI® watercraft parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki JET SKI® watercraft are introduced by the Service Manual. Genuine parts provided as spare parts are listed in the Parts Catalog.
- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

How to Use This Manual

In this manual, the product is divided into its major systems and these systems make up the manual's chapters. The Quick Reference Guide shows you all of the product's system and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

For example, if you want ignition coil information, use the Quick Reference Guide to locate the Electrical System chapter. Then, use the Table of Contents on the first page of the chapter to find the Ignition Coil section.

Whenever you see these WARNING and CAUTION symbols, heed their instructions! Always follow safe operating and maintenance practices.

⚠ WARNING

This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.

CAUTION

This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.

This manual contains four more symbols (in addition to WARNING and CAUTION) which will help you distinguish different types of information.

NOTE

○ *This note symbol indicates points of particular interest for more efficient and convenient operation.*

● Indicates a procedural step or work to be done.

○ Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a NOTE.

★ Indicates a conditional step or what action to take based on the results of the test or inspection in the procedural step or sub-step it follows.

In most chapters an exploded view illustration of the system components follows the Table of Contents. In these illustrations you will find the instructions indicating which parts require specified tightening torque, oil, grease or a locking agent during assembly.

This model, JT1500B, is mounted with a four -stroke engine with supercharger.

When the JET SKI® watercraft is submerged and swamped, the four-stroke engine needs special care and systematic procedure for recovery compared with the two-stroke engine. Therefore in this manual, such procedures, which are not shown in SMs for two-stroke engines, are explained thoroughly to cope with the cases.

Refer to the section, After submerging in Chapter 9, Cooling and Bilge Systems for the summary and detailed procedures.

General Information

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Before Servicing

Before starting to perform an inspection service or carry out a disassembly and reassembly operation on watercraft, read the precautions given below. To facilitate actual operations, notes, illustrations, photographs, cautions, and detailed descriptions have been included in each chapter wherever necessary. This section explains the items that require particular attention during the removal and reinstallation or disassembly and reassembly of general parts.

Especially note the following:

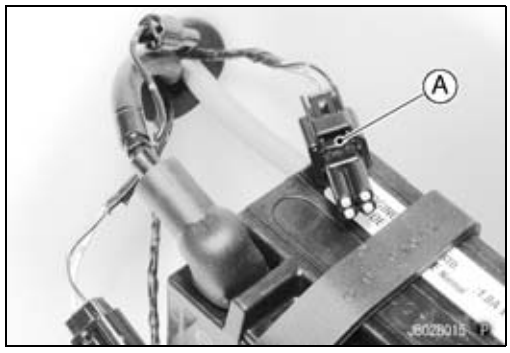
Kawasaki Diagnostic System (KDS) Software

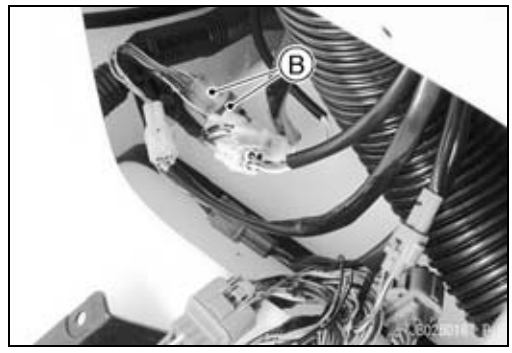
KDS software that runs on Windows personal computer (PC) will be available as a diagnostic tool for watercraft with Kawasaki DFI system.

You need the following items to use the KDS.

Item	P/No.
KDS Software Version 2.□ (CD-ROM, Updated Version)	57001-1503
Signal Converter	57001-1504
Communication Cable and Cable Adapter	57001-1470
KDS Adapter Cable	57001-1696

The connectors for the communication cable and KDS adapter cable are located in the front. Connect the communication cable to the KDS connector (4-pin) [A] and the KDS adapter cable between the ignition switch (immobilizer amplifier) lead connectors (6-pin) [B].





Adjustments

Adjustments shall be made in accordance with the Periodic Maintenance Chart or whenever troubleshooting or presence of symptoms indicate that adjustments may be required. Whenever running of the engine is required during maintenance it is best to have the watercraft in water.

CAUTION
Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

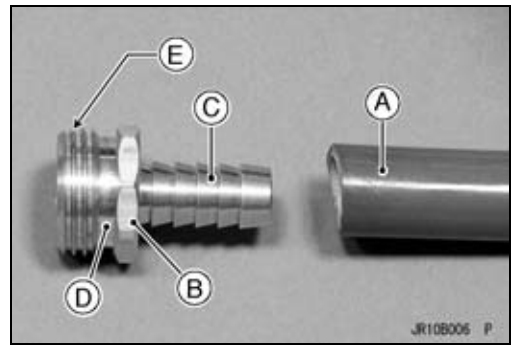
Auxiliary Cooling

An auxiliary cooling supply may be used if the watercraft cannot be operated in water during adjustments. If possible, always operate the watercraft in water rather than use an auxiliary cooling supply.

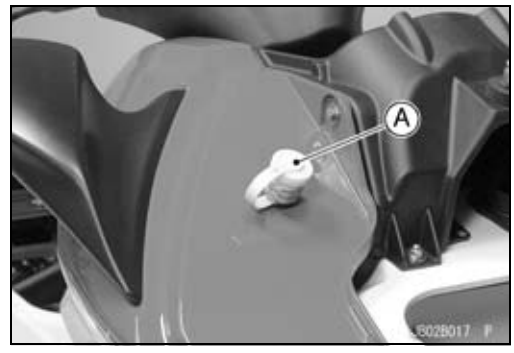
Before Servicing

- Obtain a standard garden hose [A] and a garden hose adapter [B] as shown.
  C: Garden Hose Fitting of Adapter
  D: Flushing Fitting of Adapter
  E: Thread: Rp 3/4

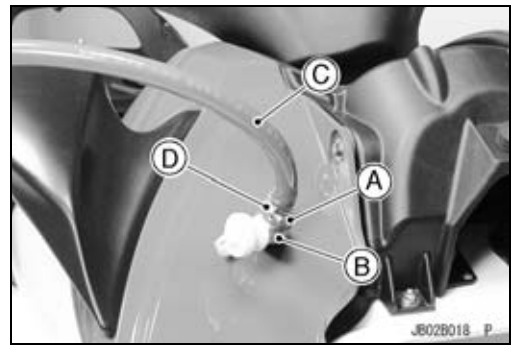
○Optional part (P/No. 92005-3746) is available as a garden hose adapter.



- Open the front storage compartment cover.
- Remove the flushing cap [A] on the brim of the storage compartment.



- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].



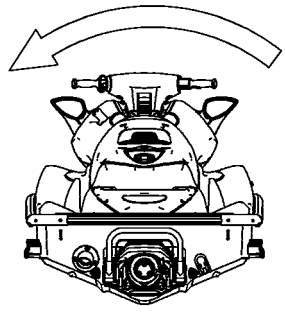
- Attach the garden hose to a faucet. Do not turn on the water until the engine is running and turn it off immediately when the engine stops. The engine requires 2.4 L/min (2.5 qts/min) at 1 800 rpm and 7.0 L/min (7.4 qts/min) at 6 000 rpm.

CAUTION

Insufficient cooling supply will cause the engine and/or exhaust system to overheat and severe damage will occur. Excessive cooling supply may kill the engine and flood the cylinders, causing hydraulic lock. Hydraulic lock will cause severe damage to the engine. If the engine dies while using an auxiliary cooling supply, the water must be shut off immediately.

CAUTION

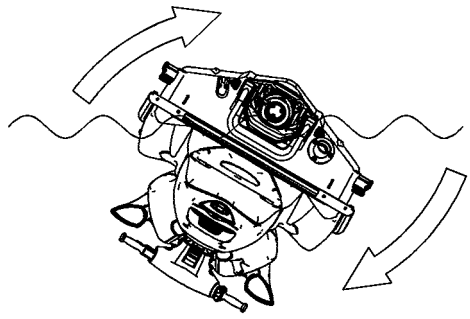
Always turn the boat on its left side. Rolling to the right side can cause water in the exhaust system to run into the engine, with possible engine damage.



Before Servicing

CAUTION

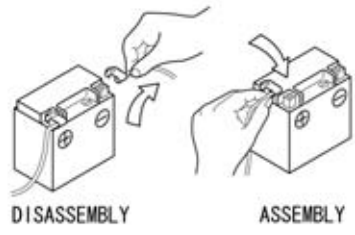
Turn the capsized boat clockwise so that the port side always faces downward. Turning counterclockwise can cause water in the exhaust system to run into the engine, with possible engine damage.



JB02018BWI C

Battery Ground

Before completing any service on the watercraft, disconnect the battery wires from the battery to prevent the engine from accidentally turning over. Disconnect the ground wire (–) first and then the positive (+). When completed with the service, first connect the positive (+) wire to the positive (+) terminal of the battery then the negative (–) wire to the negative terminal.



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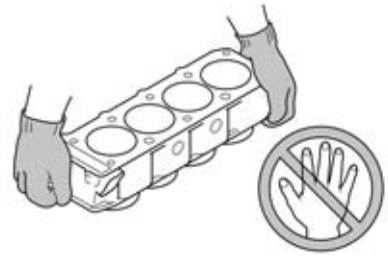
Edges of Parts

Lift large or heavy parts wearing gloves to prevent injury from possible sharp edges on the parts.



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Solvent

Use a high flush point solvent when cleaning parts. High flush point solvent should be used according to directions of the solvent manufacturer.

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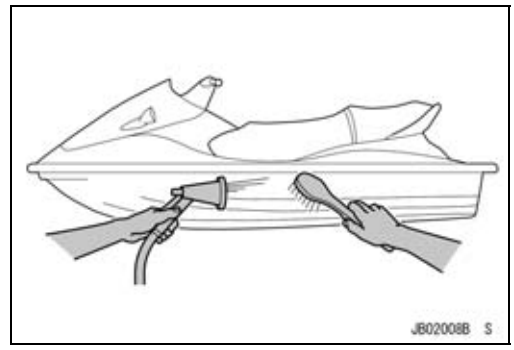
Before Servicing

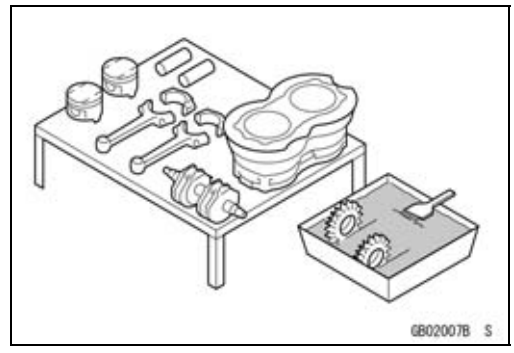
Cleaning Watercraft before Disassembly

Clean the watercraft thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during watercraft disassembly can cause excessive wear and decrease performance of the watercraft.



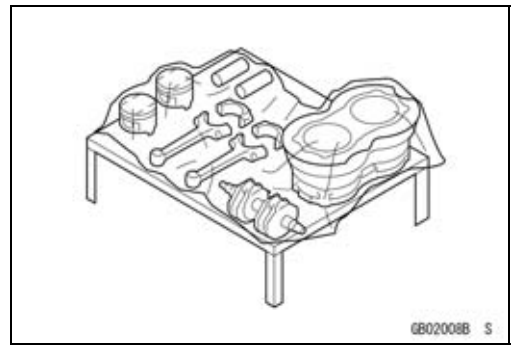
Arrangement and Cleaning of Removed Parts

Disassembled parts are easy to confuse. Arrange the parts according to the order the parts were disassembled and clean the parts in order prior to assembly.



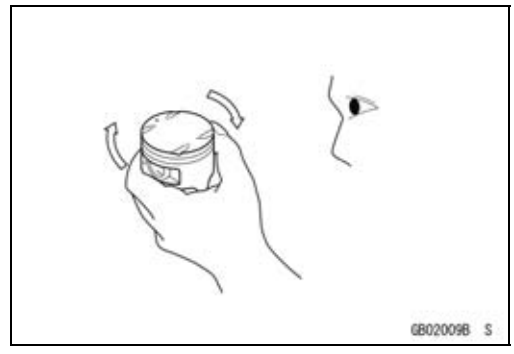
Storage of Removed Parts

After all the parts including subassembly parts have been cleaned, store the parts in a clean area. Put a clean cloth or plastic sheet over the parts to protect from any foreign materials that may collect before re-assembly.



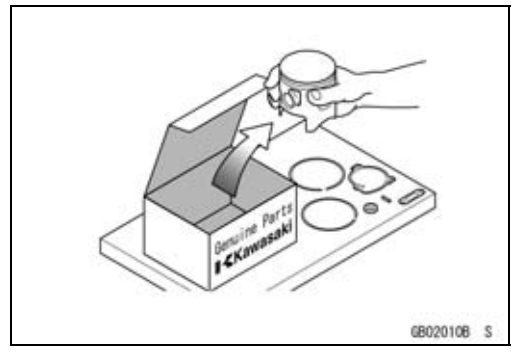
Inspection

Reuse of worn or damaged parts may lead to serious accident. Visually inspect removed parts for corrosion, discoloration, or other damage. Refer to the appropriate sections of this manual for service limits on individual parts. Replace the parts if any damage has been found or if the part is beyond its service limit.



Replacement Parts

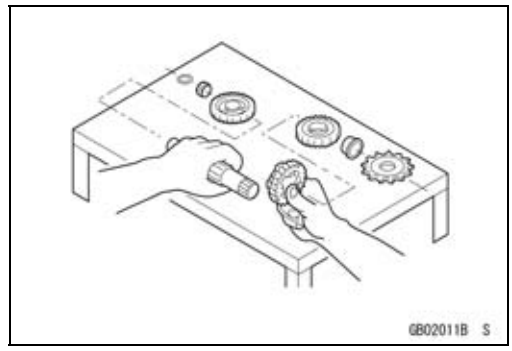
Replacement Parts must be KAWASAKI genuine or recommended by KAWASAKI. Gaskets, O-rings, Oil seals, Grease seals, circlips or cotter pins must be replaced with new ones whenever disassembled.



Before Servicing

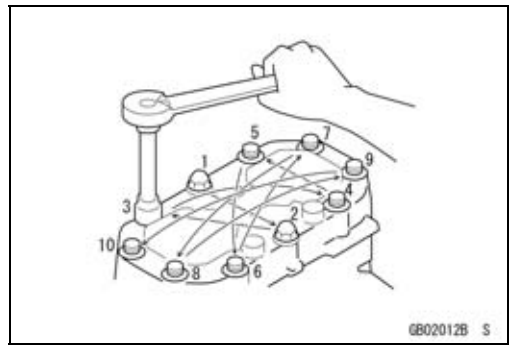
Assembly Order

In most cases assembly order is the reverse of disassembly, however, if assembly order is provided in this Service Manual, follow the procedures given.



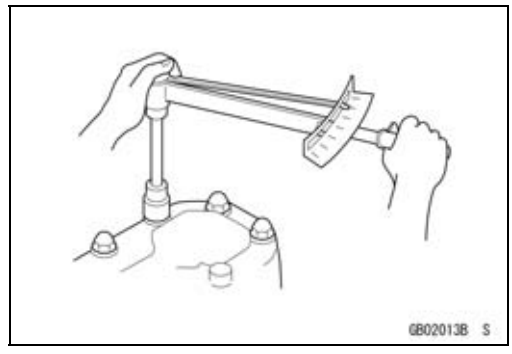
Tightening Sequence

Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them according to the specified sequence to prevent case warpage or deformation which can lead to malfunction. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter turn and then remove them. If the specified tightening sequence is not indicated, tighten the fasteners alternating diagonally.



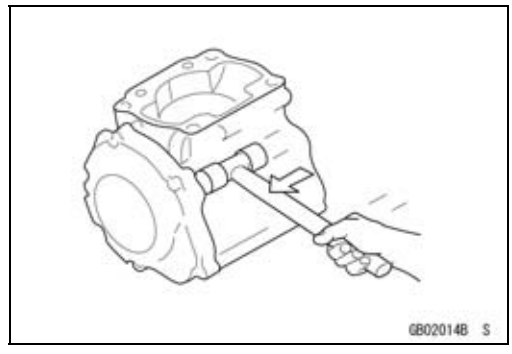
Tightening Torque

Incorrect torque applied to a bolt, nut, or screw may lead to serious damage. Tighten fasteners to the specified torque using a good quality torque wrench.



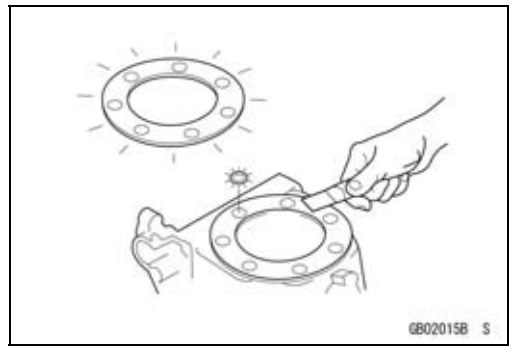
Force

Use common sense during disassembly and assembly, excessive force can cause expensive or hard to repair damage. When necessary, remove screws that have a non -permanent locking agent applied using an impact driver. Use a plastic-faced mallet whenever tapping is necessary.



Gasket, O-ring

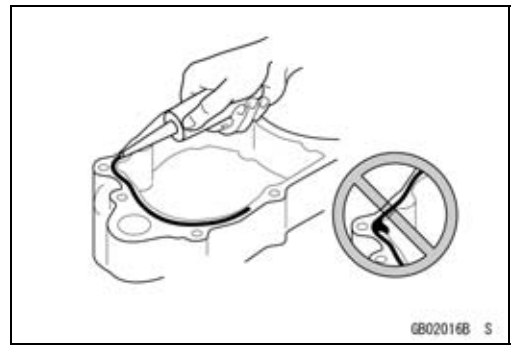
Hardening, shrinkage, or damage of both gaskets and O-rings after disassembly can reduce sealing performance. Remove old gaskets and clean the sealing surfaces thoroughly so that no gasket material or other material remains. Install new gaskets and replace used O-rings when re-assembling



Before Servicing

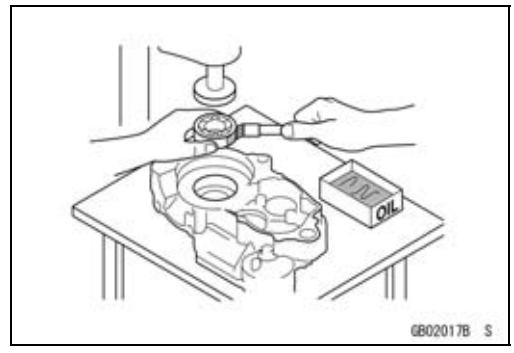
Liquid Gasket, Locking Agent

For applications that require Liquid Gasket or a Locking agent, clean the surfaces so that no oil residue remains before applying liquid gasket or locking agent. Do not apply them excessively. Excessive application can clog oil passages and cause serious damage.



Press

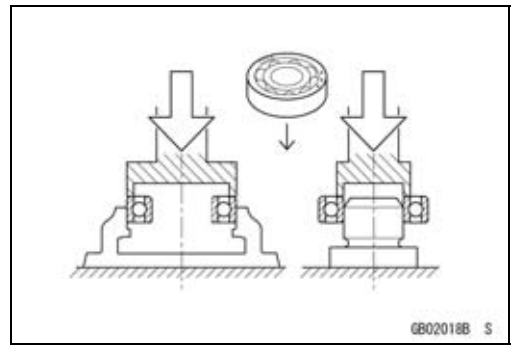
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



Ball Bearing

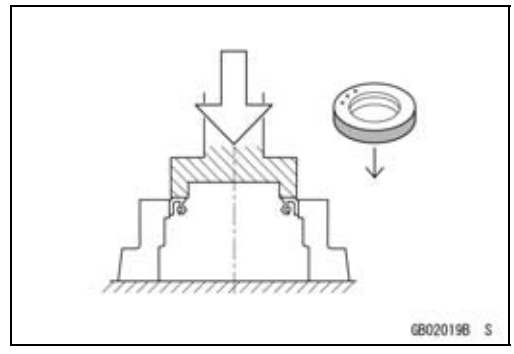
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

Pressing the incorrect race can cause pressure between the inner and outer race and result in bearing damage.

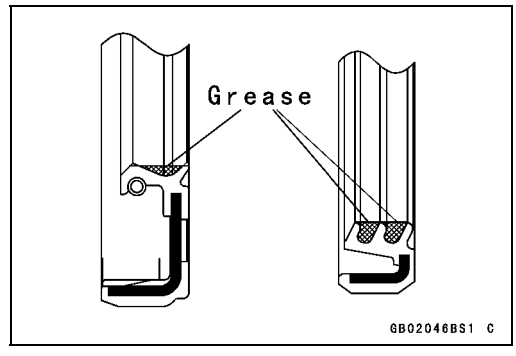


Oil Seal, Grease Seal

Do not remove pressed oil or grease seals unless removal is necessary. Replace with new ones whenever removed. Press new oil seals with manufacture and size marks facing out. Make sure the seal is aligned properly when installing.



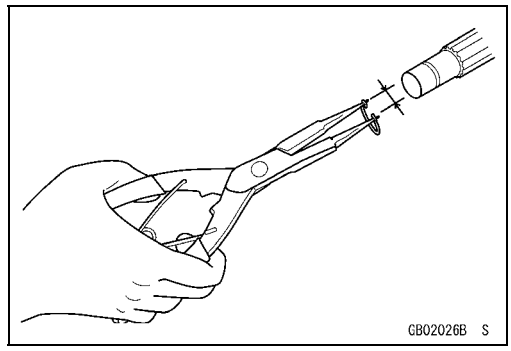
Apply specified grease to the lip of seal before installing the seal.



Before Servicing

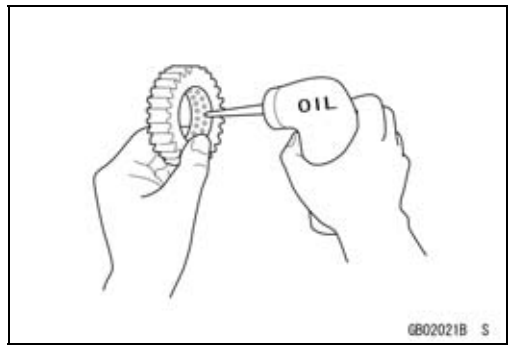
Circlips, Cotter Pins

Replace circlips or cotter pins that were removed with new ones. Take care not to open the clip excessively when installing to prevent deformation.



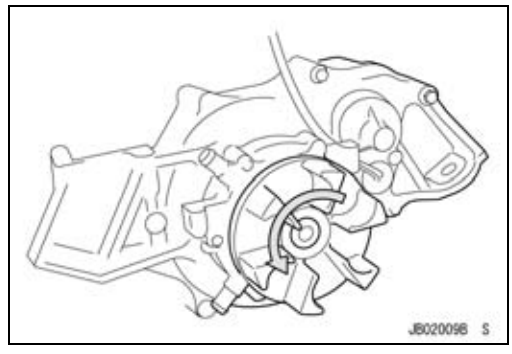
Lubrication

It is important to lubricate rotating or sliding parts during assembly to minimize wear during initial operation. Lubrication points are called out throughout this manual, apply the specific oil or grease as specified.



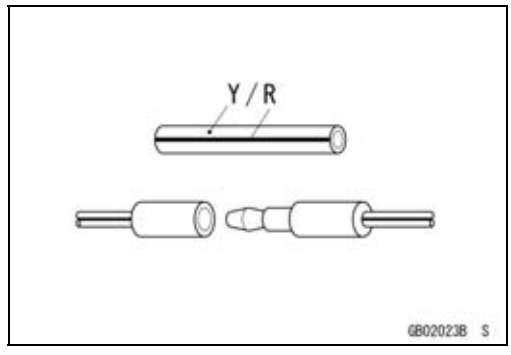
Direction of Engine Rotation

When rotating the crankshaft, by hand, the free play amount of rotating direction will affect the adjustment. Rotate the crankshaft to positive direction (counter-clockwise viewed from stern sinde).



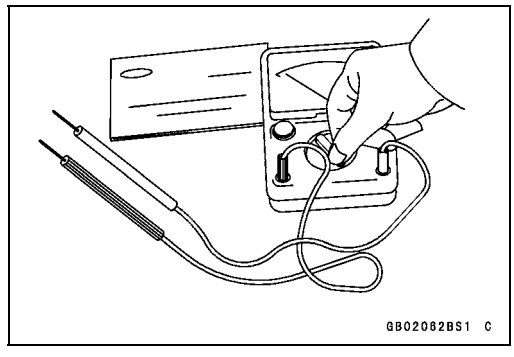
Electrical Wires

A two-color wire is identified first by the primary color and then the stripe color. Unless instructed otherwise, electrical wires must be connected to those of the same color.



Instrument

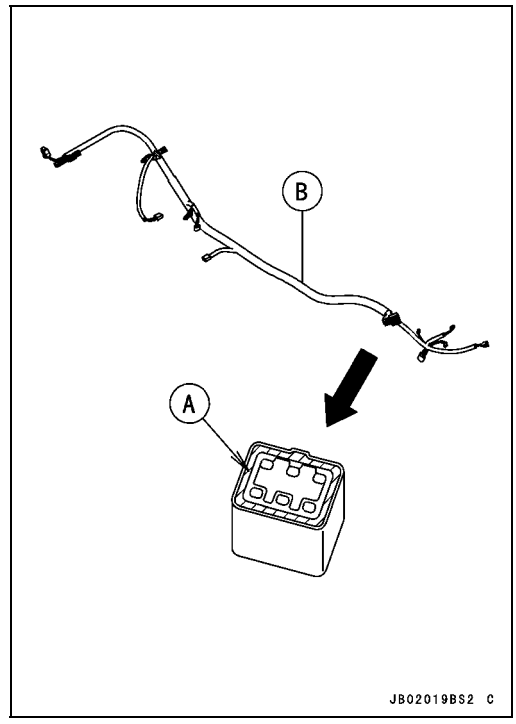
Use a meter that has enough accuracy for an accurate measurement. Read the manufacture's instructions thoroughly before using the meter. Incorrect values may lead to improper adjustments.



Before Servicing

Harness Connector

Apply grease [A] on all connectors of harness [B] for water resistance. Do not apply grease on the only connector of inlet air pressure sensor.

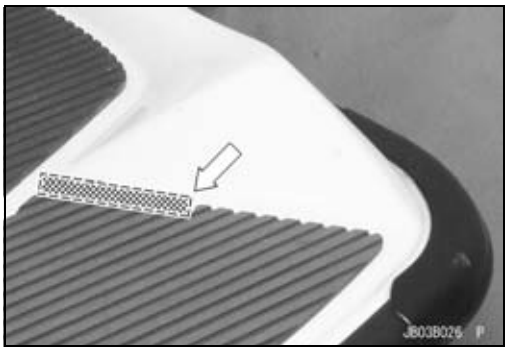


Model Identification

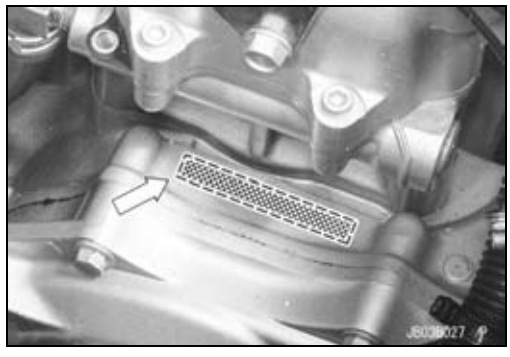
JT1500B7F Left Side View

JT1500B7F Right Side View

Hull Identification Number (HIN)



Engine Number



General Specifications

Items	JT1500B7F ~
Engine	
Type	4-stroke, DOHC, 4-cylinder, water cooled
Displacement	1 498 cm³ (91.4 cu in.)
Bore and Stroke	83 × 69.2 mm (3.27 × 2.72 in.)
Compression Ratio	7.8 : 1
Maximum Horsepower	184 kW (250 PS) @7 750 r/min (rpm)
Maximum Torque	237 N·m (24.2 kgf·m, 174.8 ft·lb) @6 500 r/min (rpm)
Ignition System	Digital transistor
Lubrication System	Forced lubrication (semi-dry sump)
Carburetion System	FI (fuel injection) MIKUNI AC 60 × 1
Starting System	Electric starter
Cylinder Numbering Method	Front (bow) to rear (stern), 1-2-3-4
Firing Order	1-2-4-3
Valve Timing:	
Inlet:	
Open	15° BTDC
Close	65° ABDC
Duration	260°
Exhaust:	
Open	73.5° BBDC
Close	8.5° ATDC
Duration	262°
Tuning Specifications	
Spark plug:	
Type	NGK PMR9B
Gap	0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)
Ignition Timing	0° ATDC @1 300 r/min ~ 8° BTDC @3 000 r/min (rpm)
Idle Speed	1 300 ±100 r/min (rpm) -in water 1 300 ±100 r/min (rpm) -out of water
Compression Pressure	1 190 ~ 1 799 kPa (12.1 ~ 18.3 kgf/cm², 173 ~ 261 psi) @430 r/min (rpm)
Drive System	
Coupling	Direct drive from engine
Jet Pump:	
Type	Axial flow single stage
Thrust	6 780 N (692 kgf, 1 524 lb)
Steering	Steerable nozzle
Braking	Water drag
Performance	
†Minimum Turning Radius	4.0 m (13.1 ft)
†Fuel Consumption	74.5 L/h (19.7 US gal/h) @full throttle
†Cruising Range	105 km (65.2 mile) @full throttle 59 minutes (3 person)
Dimensions	
Overall Length	3 370 mm (132.7 in.)

General Specifications

Items	JT1500B7F ~
Overall Width	1 195 mm (47.0 in.)
Overall Height	1 150 mm (45.3 in.)
Dry Weight:	
JT1500B7F	416 kg (917 lb)
JT1500B8F	410 kg (904 lb)
Fuel Tank Capacity	78 L (20.6 US gal)
Engine Oil	
Type	API SE, SF or SG API SH, SJ or SL with JASO MA
Viscosity	SAE 10W-40
Capacity	5.0 L (5.3 US qt)
Electrical Equipment	
Battery	12 V 18 Ah
Maximum Generator Output	16 A @14 V

†: This information shown here represents results under controlled conditions, and the information may not be correct under other conditions.

Specifications subject to change without notice, and may not apply to every country.

Unit Conversion Table

Prefixes for Units

Prefix	Symbol	Power
mega	M	× 1 000 000
kilo	k	× 1 000
centi	c	× 0.01
milli	m	× 0.001
micro	μ	× 0.000001

Units of Mass

kg	×	2.205	=	lb
g	×	0.03527	=	oz

Units of Volume

L	×	0.2642	=	gal (US)
L	×	0.2200	=	gal (imp)
L	×	1.057	=	qt (US)
L	×	0.8799	=	qt (imp)
L	×	2.113	=	pint (US)
L	×	1.816	=	pint (imp)
mL	×	0.03381	=	oz (US)
mL	×	0.02816	=	oz (imp)
mL	×	0.06102	=	cu in

Units of Force

N	×	0.1020	=	kg
N	×	0.2248	=	lb
kg	×	9.807	=	N
kg	×	2.205	=	lb

Units of Length

km	×	0.6214	=	mile
m	×	3.281	=	ft
mm	×	0.03937	=	in.

Units of Torque

N·m	×	0.1020	=	kgf·m
N·m	×	0.7376	=	ft·lb
N·m	×	8.851	=	in·lb
kgf·m	×	9.807	=	N·m
kgf·m	×	7.233	=	ft·lb
kgf·m	×	86.80	=	in·lb

Units of Pressure

kPa	×	0.01020	=	kgf/cm²
kPa	×	0.1450	=	psi
kPa	×	0.7501	=	cmHg
kgf/cm²	×	98.07	=	kPa
kgf/cm²	×	14.22	=	psi
cmHg	×	1.333	=	kPa

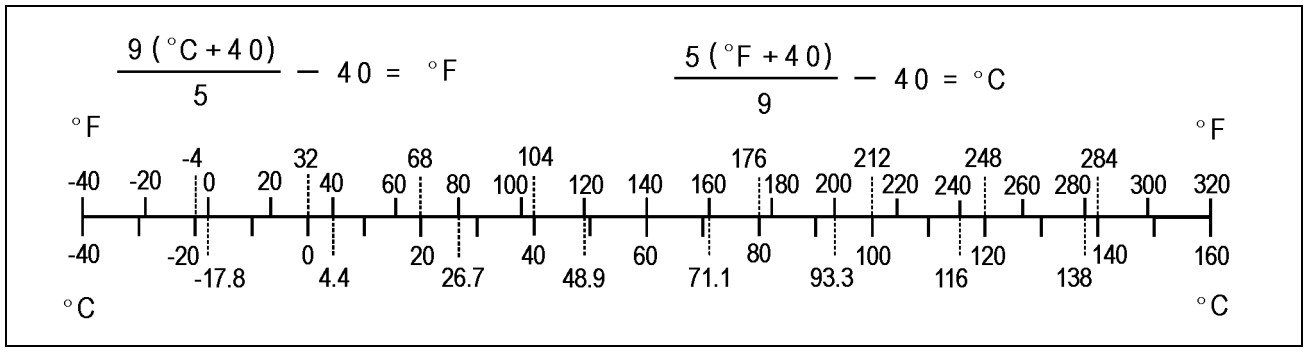
Units of Speed

km/h	×	0.6214	=	mph

Units of Power

kW	×	1.360	=	PS
kW	×	1.341	=	HP
PS	×	0.7355	=	kW
PS	×	0.9863	=	HP

Units of Temperature



Periodic Maintenance

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2-2 PERIODIC MAINTENANCE

Periodic Maintenance Chart

The scheduled maintenance must be done in accordance with this chart to keep the watercraft in good running condition. **The initial maintenance is vitally important and must not be neglected.**

Frequency / Description	Initial 10 Hours	Every 25 Hours	Every 50 Hours	Every 100 Hours	Reference
Inspect throttle control system (e)		●			2-12
Inspect/clean air box drain caps		●			2-12
Inspect supercharger drive belt for wear/damage and belt tension	●	●			2-13
Inspect supercharger gear oil level (refill if necessary)			● (or every year)		2-15
Inspect fuel vent check valve		●			2-16
Clean fuel pump screen (e)		●			2-16
Inspect throttle shaft spring (replace throttle body if necessary) (e)				●	2-17
Replace engine oil			● (or every year)		2-17
Replace engine oil filter				●	2-18
Check air suction valve (JT1500B7F Model)				●	2-19
Inspect/adjust valve clearance (e)				●	2-19
Inspect/tighten engine mounting bolts			● (or every year)		2-24
Inspect/replace coupling damper				●	2-24
Flush cooling system (after each use in salt water)		●			2-25
Flush bilge line and filter		●			2-26
Inspect impeller blades for damage (remove)				●	2-27
Inspect steering cable/shift cable				●	2-27
Lubricate handlebar pivot (disassemble)		●			2-28
Inspect hull drain screws (replace if necessary)			●		2-28
Inspect battery charging condition		●			2-29
Inspect battery terminals		●			2-29
Inspect spark plugs (replace if necessary) (e)		●			2-30
Lubricate throttle cable fitting at throttle body		●			2-30
Lubricate throttle cable and throttle fitting at throttle case		●			2-31
Lubricate steering cable/shift cable ball joints and steering nozzle/reverse bucket pivots		●			2-31

Periodic Maintenance Chart

Frequency / Description	Initial 10 Hours	Every 25 Hours	Every 50 Hours	Every 100 Hours	Reference
Check all hoses, hose clamps, nuts, bolts, and fasteners	●	●			2-33

(e): Emission Related Items

Torque and Locking Agent

The following table list the tightening torque for the major fasteners, and the parts requiring use of a non-permanent locking agent or silicone sealant.

Letters used in the “Remarks” column mean:
EO: Apply oil to the threads and seating surface.
L: Apply a non-permanent locking agent (Medium Strength: Loctite 242 Equivalent).
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 Equivalent).
MO: Apply molybdenum disulfide grease oil solution.
R: Replacement Part
S: Tighten the fasteners following the specified sequence.
SS: Apply silicone sealant to the threads.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System				
Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
Bracket Mounting Bolts	8.8	0.90	78 in·lb	L
Inlet Manifold Mounting Bolts	25	2.5	18	
Inlet Manifold Mounting Nuts	20	2.0	14	
Delivery Pipe Mounting Bolts	7.8	0.80	69 in·lb	
Inlet Air Pressure Sensor Bracket Bolts	8.8	0.90	78 in·lb	L
Inlet Air Temperature Sensor	20	2.0	14	
Throttle Body Assy Mounting Bolts	20	2.0	14	
Inlet Manifold Drain Plug	20	2.0	14	
Throttle Body Assy Damper Bolts	20	2.0	78 in·lb	
Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Water Temperature Sensor	15	1.5	11	see text
Oil Temperature Sensor	15	1.5	11	see text
ECU Mounting Bolts	3.0	0.3	27 in·lb	L
Relay Bolts	2.5	0.25	22 in·lb	L
Throttle Sensor Mounting Screws	2.0	0.20	18 in·lb	
ISC Actuator Mounting Bolts	4.9	0.50	43 in·lb	
Fuse Bracket Bolt	2.5	0.25	22 in·lb	L
Harness Bolts	8.8	0.90	78 in·lb	L
Charging Temperature Sensor	15	1.5	11	
Fuel Filler Tube Clamp Screws	2.9	0.30	26 in·lb	
Fuel Pump Holder Clamp Screws	2.9	0.30	26 in·lb	
Oil Separator Tank Mounting Bolts	8.8	0.90	69 in·lb	L
Air Box Bracket Bolts	8.8	0.90	69 in·lb	L
Air Box Bolts	8.8	0.90	69 in·lb	L
Rear Supercharger Bolts	45	4.6	33	
Belt Tensioner Plate Bolts	45	4.6	33	
Belt Tensioner Shaft Bolt	30	3.1	22	
Intake Pipe Bolts (IN/OUT)	7.8	0.80	69 in·lb	
Gear Oil Level Gauge	19	1.9	14	
Front Supercharger Bolts	45	4.6	33	
Drain Bolt	19	1.9	14	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Pulley Bolt	19	1.9	14	
Belt Cover Bolts	4.9	0.50	43 in·lb	L
Intercooler Plate Bolts	8.8	0.90	69 in·lb	L
Intercooler Bracket Bolts	7.8	0.80	69 in·lb	
Intercooler Mounting Bolts	30	3.1	22	
Water Hose Joint	11	1.1	95 in·lb	L
Water Hose Joint	20	2.0	14	L
Intercooler Cover Bolts	10	1.0	89 in·lb	
Blow off Valve Bolts	7.8	0.80	69 in·lb	
Throttle Cable Locknuts	20	2.0	14	
Pulley Plate Bolts	15	1.5	11	L
Belt Tension Adjuster	3.0	0.31	27 in·lb	
Engine Lubrication System				
Breather Plate Bolts	7.8	0.80	69 in·lb	
Oil Filler Cap	–	–	–	Hand-tighten
Oil Passage Plugs	20	2.0	14	L
Oil Separator Tank Mounting Bolts	4.9	0.50	43 in·lb	L
Breather Case Mounting Bolts	7.8	0.80	69 in·lb	
Breather Pipe Bolts	8.8	0.90	78 in·lb	
Oil Passage Joints	11	1.1	95 in·lb	L
Oil Cooler Assembly Bolts	7.8	0.80	69 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Oil Passage Bolt	78	8.0	58	S
Oil Filter	18	1.8	13	EO
Oil Cooler Positioning Bolt	20	2.0	14	S
Oil Pan Bolts	7.8	0.80	69 in·lb	S
Dipstick Tube Bolts	7.8	0.80	69 in·lb	L, S
Oil Pump Sprocket Bolt	16	1.6	12	LN
Oil Pump Cover Bolts	7.8	0.80	69 in·lb	
Oil Pressure Relief Valve	15	1.5	11	LN
Oil Pipe Bolts	7.8	0.80	69 in·lb	
Oil Pump Chain Guide Bolt	7.8	0.80	69 in·lb	
Chain Guide Spring Plate Bolt	7.8	0.80	69 in·lb	
Oil Pump Body Plug	20	2.0	14	L
Oil Pump Body Bolts	7.8	0.80	69 in·lb	
Oil Screen Bolts	7.8	0.80	69 in·lb	
Water Hose Joints	20	2.0	14	SS
Exhaust System				
Exhaust Manifold Mounting Nuts	30	3.1	22	
Exhaust Manifold Mounting Bolts	30	3.1	22	
Bypass Nozzle	–	–	–	LN
Flushing Hose Joints	11	1.1	95 in·lb	L
Water Temperature Sensor	15	1.5	11	see chapter 3

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Exhaust Pipe Mounting Bolt (L = 150 mm)	45	4.6	33	
Exhaust Pipe Mounting Bolts (L = 120 mm)	35	3.6	26	
Exhaust Pipe Mounting Bolts (L = 95 mm)	35	3.6	26	
Mark Plate Bolts	5.0	0.51	44 in·lb	
Water Hose Joint	20	2.0	14	L
Muffler Body Bolts	35	3.6	26	
Front Exhaust Tube Clamp Screws (JT1500B7F)	2.9	0.30	26 in·lb	
Front Exhaust Tube Clamp Screws (JT1500B8F)	4.9	0.50	43 in·lb	
Water Hose Joint	11	1.1	95 in·lb	L
Rear Exhaust Tube Clamp Screws (JT1500B8F)	4.9	0.50	43 in·lb	
Engine Top End				
Air Suction Valve Cover Bolts	9.8	1.0	87 in·lb	
Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
Camshaft Cap Bolts	12	1.2	104 in·lb	S
Cylinder Head Bolts (M7)	20	2.0	14	S
Cylinder Head Bolts (M11)	23	2.3	17	First, MO, S
Cylinder Head Bolts (M11)	69	7.0	51	Final, MO, S
Water Jacket Plugs	20	2.0	14	L
Cylinder Head Bolts (M6)	12	1.2	104 in·lb	S
Engine Hook Bolts	20	2.0	14	
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Water Hose Joints	20	2.0	14	L
Cylinder Head Cover Plate Bolts	7.8	0.80	69 in·lb	
Exhaust Side Camshaft Chain Guide Bolts (Upper)	25	2.5	18	
Exhaust Side Camshaft Chain Guide Bolts (Lower)	12	1.2	104 in·lb	
Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
Inlet Side Camshaft Chain Guide Bolt	12	1.2	104 in·lb	L
Camshaft Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	L
Camshaft Chain Tensioner Cap Bolt	20	2.0	14	
Camshaft Position Sensor Rotor Bolt	12	1.2	104 in·lb	L
Water Hose Joint	20	2.0	14	L
Oil Passage Joint	11	1.1	95 in·lb	L
Engine Removal/Installation				
Engine Mounting Bolts	36	3.7	27	L
Engine Damper Mounting Bolts	16	1.6	12	L
Engine Bottom End				
Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
Engine Bracket Mounting Bolts	32	3.3	24	L

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Timing Rotor Bolt	20	2.0	14	L
Connecting Rod Nuts	–	–	–	MO, see text
Oil Passage Plugs	20	2.0	14	L
Stator Mounting Bolts	12	1.2	104 in·lb	L
Grommet Cover Bolts	9.8	1.0	87 in·lb	L
Magneto Cover Bolts	20	2.0	14	
Output Cover Bolts	7.8	0.80	69 in·lb	
Output Shaft	245	25.0	180	MO
Coupling	110	11	81	
Crankcase Bolts (M10)	50	5.0	36	MO, S
Crankcase Bolts (M8)	29	3.0	22	MO, S
Crankcase Bolts (M8)	29	3.0	22	S
Crankcase Bolts (M6)	12	1.2	104 in·lb	S
Cooling and Bilge Systems				
Water Hose Joint (L Shape Type)	11	1.1	95 in·lb	L
Water Hose Joint (Straight Shape Type)	20	2.0	14	L
Cooling Hose Clamp Screws	2.5	0.25	22 in·lb	
Intercooler Bracket Bolts	7.8	0.80	69 in·lb	
Intercooler Mounting Bolts	30	3.1	22	
Intercooler Cover Bolts	10	1.0	89 in·lb	
Intercooler Plate Bolts	8.8	0.90	69 in·lb	L
Drive System				
Coupling	39	4.0	29	
Drive Shaft Holder Mounting Bolts	22	2.2	16	L
Pump and Impeller				
Pump Bracket Mounting Bolts (2)	19	1.9	14	LN, SS
Pump Bracket Mounting Bolts (4)	9.8	1.0	87 in·lb	L
Pump Mounting Bolts	36	3.7	27	L
Grate Mounting Bolts	9.8	1.0	87 in·lb	L
Pump Cover Mounting Bolts	7.8	0.80	69 in·lb	L
Impeller	98	10	72	
Pump Cap Bolts	3.9	0.4	35 in·lb	L
Pump Outlet Mounting Bolts	19	1.9	14	L
Steering Nozzle Pivot Bolts	19	1.9	14	L
Filter Cover Mounting Bolts	9.8	1.0	87 in·lb	L
Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
Steering				
Handlebar Clamp Bolts	16	1.6	12	L
Adjustable Steering Holder Nut	20	2.0	14.5	
Steering Neck Mounting Bolts	16	1.6	12	L
Steering Shaft Locknut	49 ~ 59	5.0 ~ 6.0	36 ~ 43	
Steering Holder Mounting Nuts	20	2.0	14.5	L
Throttle Case Mounting Screws	3.9	0.40	35 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
Shift Cable Nut	39	4.0	29	
Steering Cable Nut	39	4.0	29	
Steering Shaft Nut	2.9	0.30	26 in·lb	see text
Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
Ball Joint	9.8	1.0	87 in·lb	L
Shift Cable End Nut	9.8	1.0	87 in·lb	
Reverse Bucket Pivot Bolts	19	1.9	14	L
Hull/Engine Hood				
Stabilizer Bolts	9.8	1.0	87 in·lb	LN
Front Bumper Bolts	–	–	–	L
Exhaust Outlet Bolts	–	–	–	L
Handrail Plate Nuts	9.8	1.0	87 in·lb	L
Side Cover Nuts	–	–	–	L
Front Duct Bolts	–	–	–	L
Damper Bracket Bolts	–	–	–	L
Seat Lock Bolts	–	–	–	L
Front Storage Compartment Cover Bolts	–	–	–	L
Steering Cover Bolts	–	–	–	L
Meter Screen Bolts	–	–	–	LN
Bracket Bolts	8.8	0.90	78 in·lb	L
Reboarding Step Bolts	–	–	–	L
Hinge Shaft Nut	15.7	1.60	11.6	
Electrical System				
Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
Bracket Bolts	8.8	0.90	78 in·lb	L
Starter Relay Case Bolts	7.8	0.80	69 in·lb	
Water Temperature Sensor	15	1.5	11	see text
Starter Relay Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
Starter Cable Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
Oil Temperature Sensor	15	1.5	11	see text
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Regulator/Rectifier Bolts	7.8	0.80	69 in·lb	
Relay Bolts	2.5	0.25	22 in·lb	L
ECU Mounting Bolts	3.0	0.3	27 in·lb	L
Fuse Bracket Bolt	2.5	0.25	22 in·lb	L
Charging Temperature Sensor	15	1.5	11	
Multifunction Meter Mounting Bolts	3.9	0.40	35 in·lb	
Start/stop Switch Case Mounting Screw	3.9	0.40	35 in·lb	
Speed Sensor Mounting Bolts	3.9	0.40	35 in·lb	L
Starter Motor Through Bolts	6.4	0.65	56 in·lb	L, R
Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	L
Starter Motor Ground Bolt	8.8	0.90	78 in·lb	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Starter Motor Terminal Nut	8.8	0.90	78 in·lb	
Stator Coil Bolts	12	1.2	104 in·lb	L
Grommet Holder Bolts	8.8	0.90	78 in·lb	L
Ignition Coil Mounting Bolts	8.8	0.90	78 in·lb	L
Timing Rotor Bolt	20	2.0	14	L
Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
Rubber Grommet Holder Screws	4.4	0.45	39 in·lb	L
Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
Spark Plugs	13	1.3	113 in·lb	

The next table, relating tightening torque to thread diameter, lists the basic torque for the bolts and nuts. Use this table for only the bolts and nuts which do not require a specific torque value. All of the values are for use with dry solvent-cleaned threads.

General Fasteners (stainless bolt and nut)

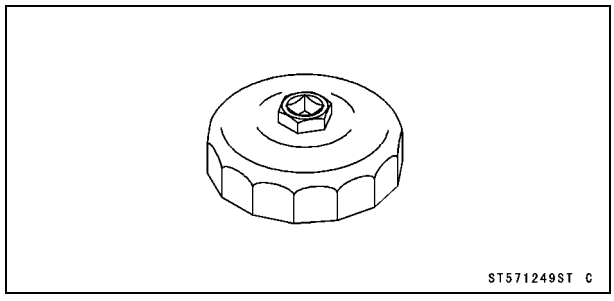
Threads dia. (mm)	Torque		
	N·m	kgf·m	ft·lb
6	5.9 ~ 8.8	0.60 ~ 0.90	52 ~ 78 in·lb
8	16 ~ 22	1.6 ~ 2.2	12 ~ 16
10	30 ~ 41	3.1 ~ 4.2	22 ~ 30

Specifications

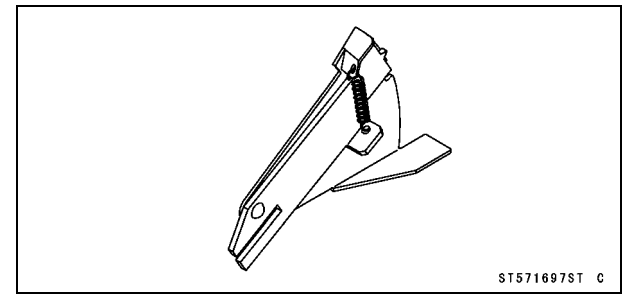
Item	Standard	Service Limit
Fuel System		
Throttle Lever Free Play	about 2 mm (0.08 in.)	– – –
Engine Lubrication System		
Engine Oil:		
Type	API SE, SF or SG API SH, SJ or SL with JASO MA	– – –
Viscosity	SAE 10W-40	– – –
Capacity	4.0 L (4.2 US qt, with or without the filter) 5.0 L (5.3 US qt, when engine is completely dry)	– – –
Engine Top End		
Valve Clearance:		
IN	0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)	– – –
EX	0.32 ~ 0.41 mm (0.0126 ~ 0.0161 in.)	– – –
Electrical System		
Spark Plug Gap	0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)	– – –

Special Tools and Sealant

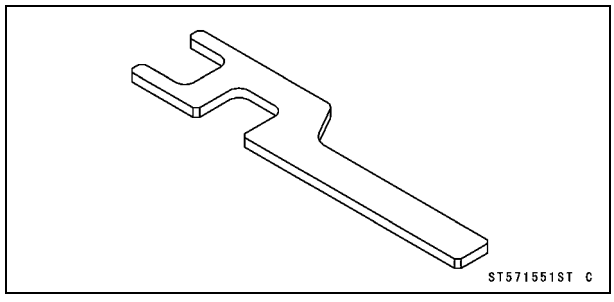
Oil Filter Wrench:
57001-1249



Belt Measuring Gauge:
57001-1697



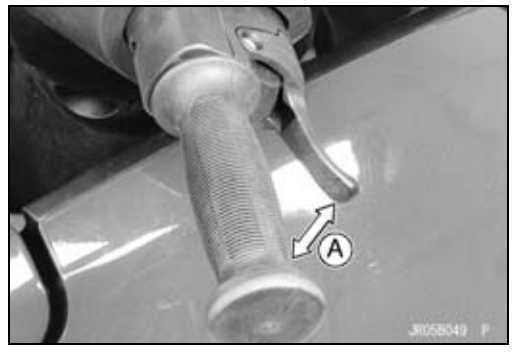
Shaft Wrench:
57001-1551



Periodic Maintenance Procedures

Fuel System

Throttle Control System Inspection



- Inspect the throttle lever free play [A].

★If the free play is incorrect, adjust the throttle cable.

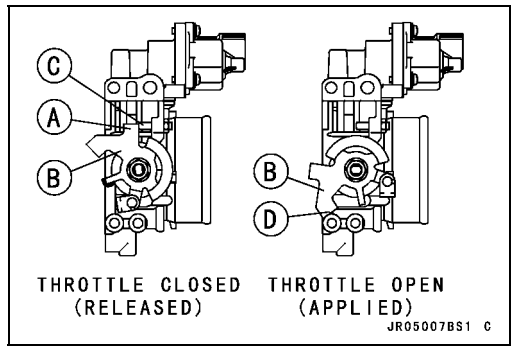
Throttle Lever Free Play
Standard: about 2 mm (0.08 in.)

- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by the return spring.

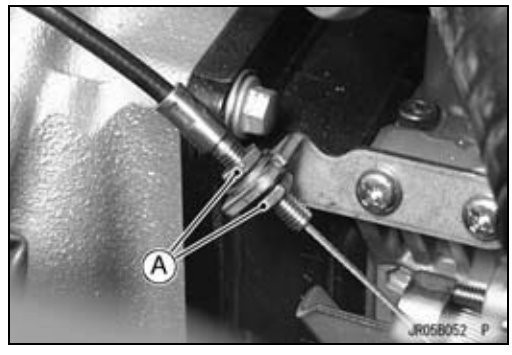
★If the throttle lever does not return properly, check the throttle cable routing, cable adjustments, and cable damage. Then lubricate the throttle cable.

- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.

★If the idle speed increase, check the throttle cable adjustment and the cable routing.



- Remove the seats (see Seat Removal in the Hull/Engine Hood chapter).
- Check throttle cable adjustment.
- With the throttle lever released, the upper stop [A] on the throttle pivot arm [B] should rest against the stopper [C] on the throttle body, and there should be slight slack in the throttle cable.
- When the throttle lever is fully applied (pulled), the lower stop [D] on the pivot arm should be all the way up against the stopper on the throttle body.



★If necessary, adjust the throttle cable.

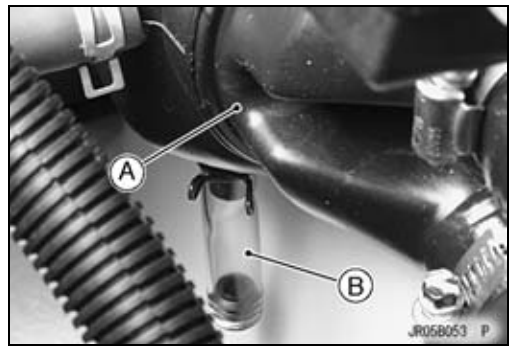
- Loosen and turn the locknuts [A] at the bracket until the upper stop on the pivot arm hits against the stopper on the throttle body with slight cable slack.
- Tighten the locknuts securely.

Torque - Throttle Cable Locknuts: 20 N·m (2.0 kgf·m, 14 ft·lb)

NOTE

○*Make sure that the throttle pivot arm stops against the stopper on the throttle body with the throttle lever released.*

Air Box Drain Cap Inspection and Cleaning



- Remove the seats (see Seat Removal in the Hull/Engine Hood chapter).
- Inspect the air box [A] for water inside with its drain cap [B].

★If there is water in the cap, remove the cap and discharge the water.

NOTE

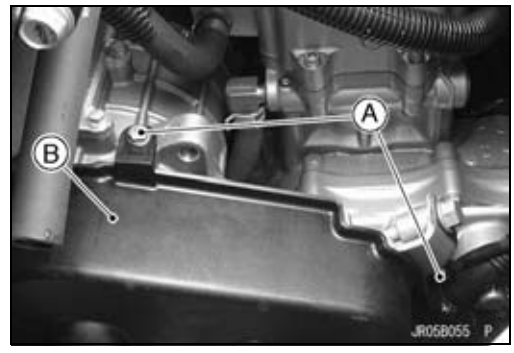
○*Be sure to have a rag or cloth underneath for possible oily water.*

Periodic Maintenance Procedures

Supercharger Drive Belt for Wear/Damage and Belt Tension Inspection

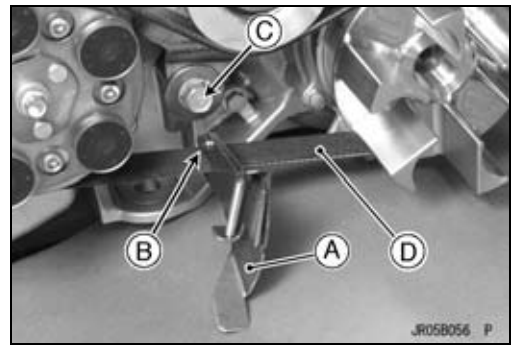
- Inspect the supercharger drive belt tension as follows.
- Disconnect the following from the oil separator tank.
  Breather Hose (to Air Box)
  Breather Hose (to Cylinder Head Cover)
- Place the oil separator tank [A] as shown.

- Remove:
  Belt Cover Bolts [A]
  Belt Cover [B]

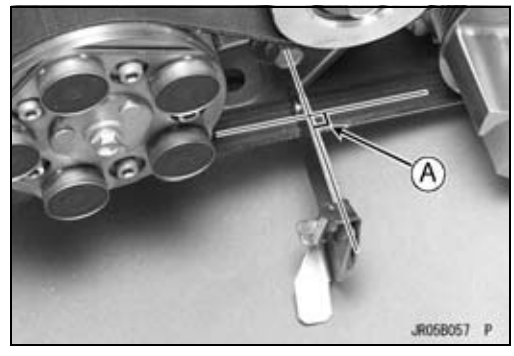


- Install the special tool [A] onto the belt [D] so that the tool's tip [B] is aligned with the tensioner plate bolt head [C].

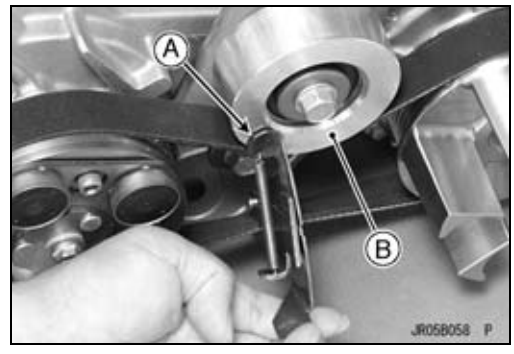
  Special Tool - Belt Measuring Gauge [D]: 57001-1697



- Ensure that the gage's body is 90 degrees [A] to the belt.



- Rotate the special tool (keeping it at 90 degrees to the belt) until it touches [A] the face [B] of the idler.



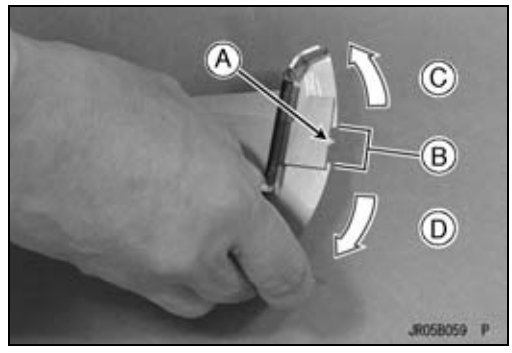
Periodic Maintenance Procedures

● Check that the gauge indicator [A] is within the area [B] of recess.

Belt Tension Range
Standard: 500 ~ 960 Nm

[C] Tension is weak.
[D] Tension is strong.

★If the gauge indicator is without the area of recess, adjust the belt tension.



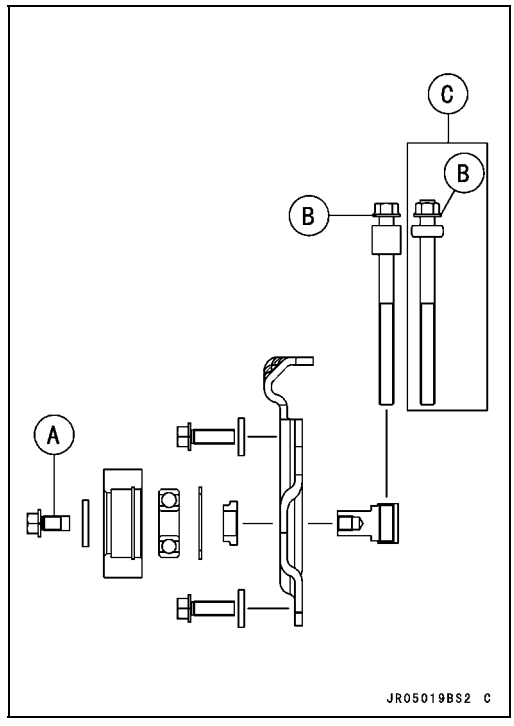
● Loosen the idler bolt [A].
● To weaken the belt tension, turn the adjuster [B] counterclockwise.
● To strengthen the belt tension, tighten the adjuster clockwise.

Torque - Belt Tension Adjuster: 3.0 N·m (0.31 kgf·m, 27 in·lb)

● Tighten the idler bolt.

Torque - Idler Bolt: 30 N·m (3.1 kgf·m, 22 ft·lb)

JT1500B8F Model [C]

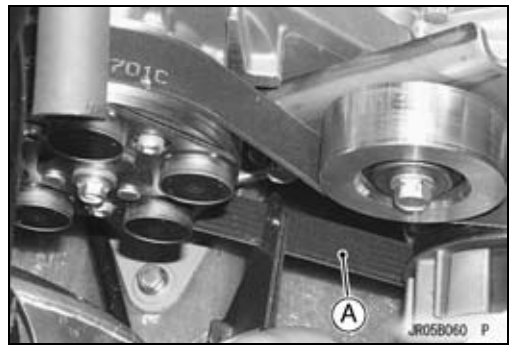


● Check the belt tension with the special tool.

Special Tool - Belt Measuring Gauge: 57001-1697

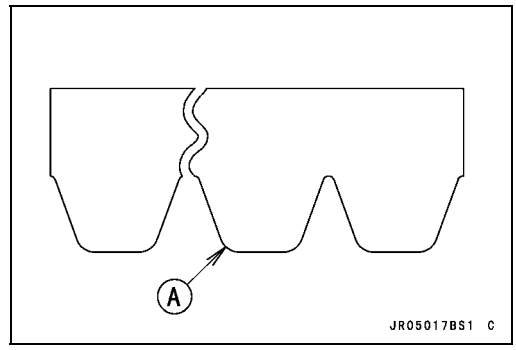
★If the gauge indicator is without the area of recess, readjust the belt tension from the first procedure.
● Lastly, disconnect the primary ignition coil lead connectors and crank the engine for 5 seconds.
● Recheck the belt tension.

● Visually inspect the belt [A] for wear and damage.
★If the nylon fabric facing of any portion is worn off, and the polyurethane compound is exposed, or belt is damaged, replace the belt with a new one.



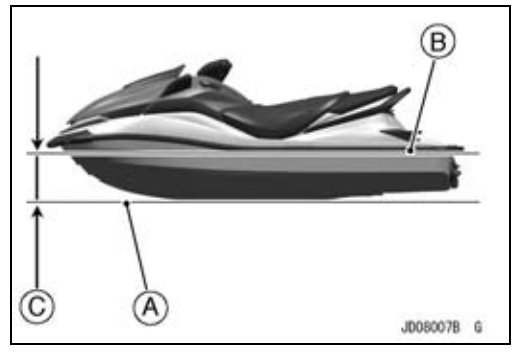
Periodic Maintenance Procedures

★If the belt teeth [A] are wear, replace the belt with a new one (see Engine Removal in the Engine Removal/Installation chapter).
★Whenever the belt is replaced, inspect the engine and supercharger pulleys (see Engine Removal in the Engine Removal/Installation chapter).

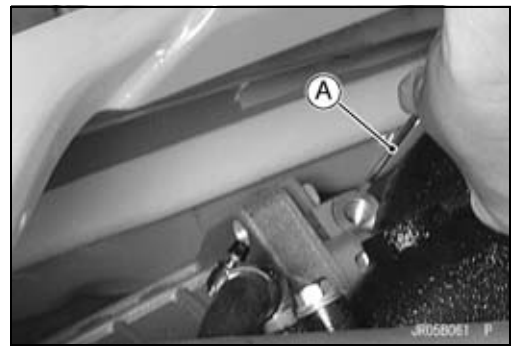


Supercharger Gear Oil Level Inspection

- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Remove the handrail plate (see Handrail Plate Removal in the Hull/Engine Hood chapter).
- Unscrew the exhaust tube clamp.
- Remove the exhaust pipe and muffler body as a set (see Exhaust Pipe and Muffler Body Removal in the Exhaust System).
- Whenever checking the supercharger gear oil level, keep the watercraft level side to side and fore to aft as much as possible.
  Level Ground [A]
  Side Bumper [B]
  Parallel [C]

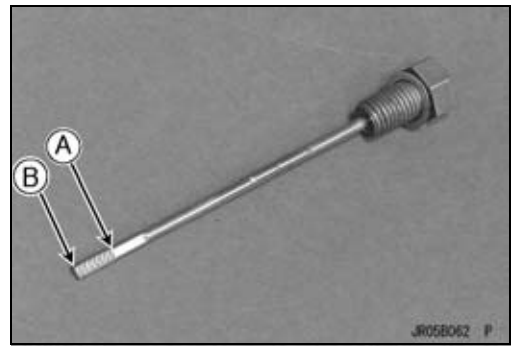


- Unscrew the oil level gauge [A].



- Remove the oil level gauge, wipe it dry and insert it back to the supercharger.
- Fully, screw in the oil level gauge into the supercharger.
- Remove the oil level gauge agail to check the oil level.
- The oil level must be between the High [A] and Low [B] level on the level gauge.

★If the oil level is too high, remove the excess oil using a syring or some other suitable device.
★If the oil level is too low, add the oil to the low level line thought the oil opening.



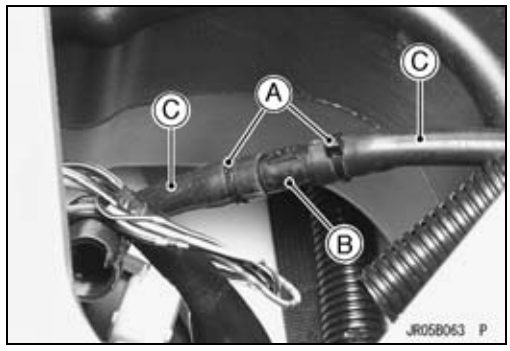
Supercharger Gear Oil:
Syntheso HT68 (NOK Kruber Brand)

Periodic Maintenance Procedures

Fuel Vent Check Valve Inspection

The fuel vent check valve is mounted in the fuel tank vent hose to prevent fuel from spilling during riding. Air can flow into the tank to allow fuel to be drawn out by the fuel pump, but fuel cannot flow out the check valve.

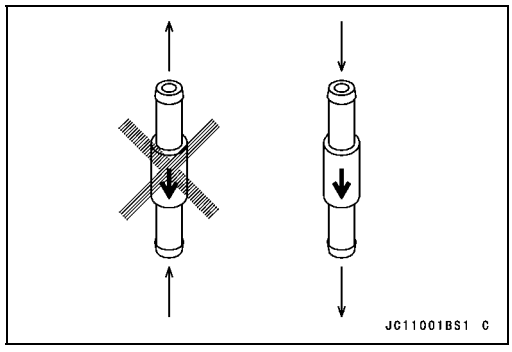
- Remove the seats (see Seat Removal in the Hull/Engine Hood chapter).
- Cut off the bands [A].
- Pull out each end of the fuel vent check valve [B] from the vent hoses [C].



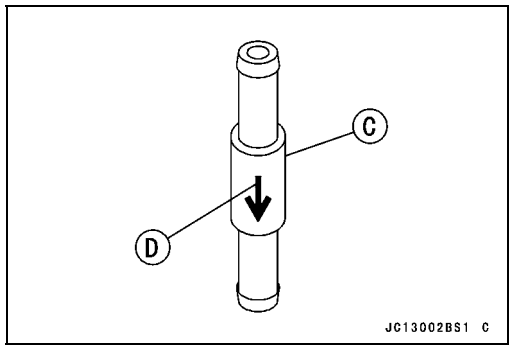
- Blow through the fuel vent check valve from each end.

★If the check valve will allow air to flow as shown, it is OK.

★If air will flow through the check valve in both direction or in neither direction, the check valve must be replaced.

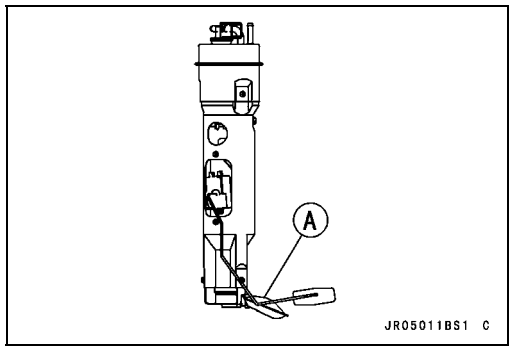


- The fuel vent check valve [C] must be mounted so that the arrow [D] on its case is pointing toward the fuel tank.



Fuel Pump Screen Cleaning

- Remove the fuel pump (see Fuel Pump Removal in the Fuel System chapter).
- Wash the fuel pump screen [A] in non-flammable of high -flash point solvent. Use a brush to remove any contaminants trapped in the screens.

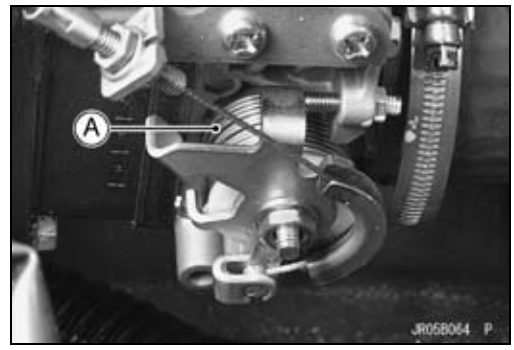


⚠ WARNING

Clean the fuel pump screen in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent. A fire or explosion could result.

Periodic Maintenance Procedures

Throttle Shaft Spring Inspection

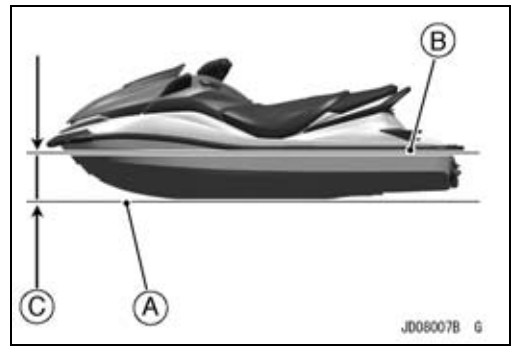


- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Check the throttle shaft spring [A] by pulling the throttle lever.

★If the springs are damaged or weak, replace the throttle body.

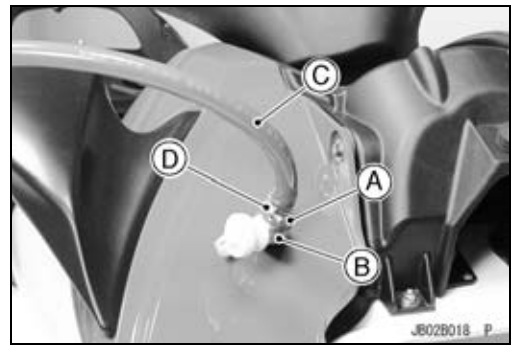
Engine Lubrication System

Engine Oil Change



- Level the watercraft port to starboard as well as fore to aft.

  Level Ground [A]
  Side Bumper [B]
  Parallel [C]



- In a well-ventilated area, start the engine while cooling the cooling system.

○Open the front storage compartment cover (see Front Storage Compartment Cover Removal in the Hull/Engine Hood chapter).

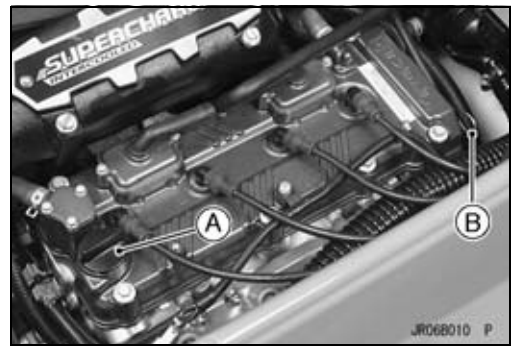
○Remove the flushing cap (see Cooling System Flushing in the Periodic Maintenance chapter).

○Screw a garden hose adapter [A] onto the flushing fitting [B].

○Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].

- Warm up the engine and stop it.

CAUTION
The engine must be running before the water is turned on and the water must be turned off before the engine is stopped. **Do not run the engine without cooling water flow for more than 15 seconds.**

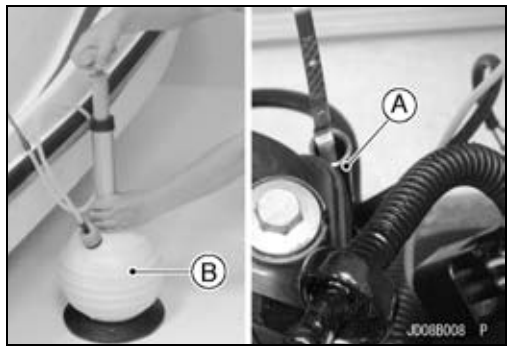


- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Remove the oil filler cap [A] and the dipstick [B].

CAUTION
Be careful not to allow any dirt or foreign materials to enter the engine.

Periodic Maintenance Procedures

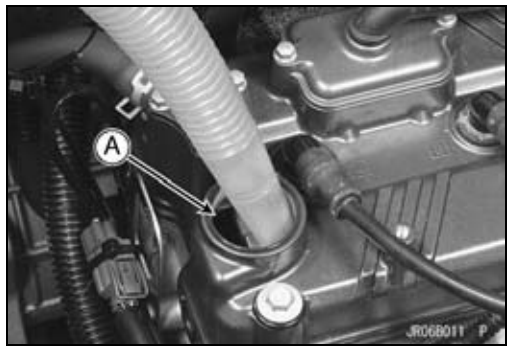
● Drain the oil thoroughly from the dipstick tube [A] using a commercially-available vacuum pump [B].



⚠ WARNING

Do not discard the engine oil as the engine oil is toxic substance and will pollute the environment. Contact your local authority for approved disposal methods.

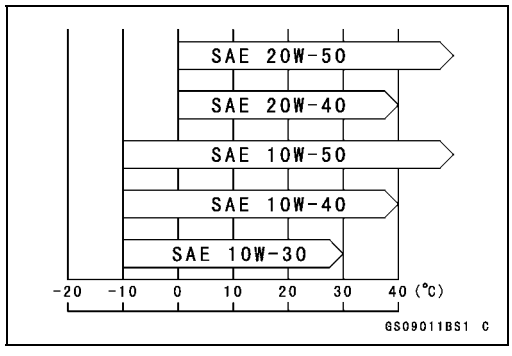
● Pour in the specified type and amount of oil through the oil filler opening [A].



Engine Oil

Grade:	**API SE, SF or SG**
	API SH, SJ or SL with JASO MA
Viscosity:	**SAE 10W-40**
Amount:	**4.0 L (4.2 US qt, with or without the filter)**
	5.0 L (5.3 US qt, when engine is completely dry)

○Depending on the atmospheric temperature of your riding area, the engine oil viscosity should be changed according to the chart shown.



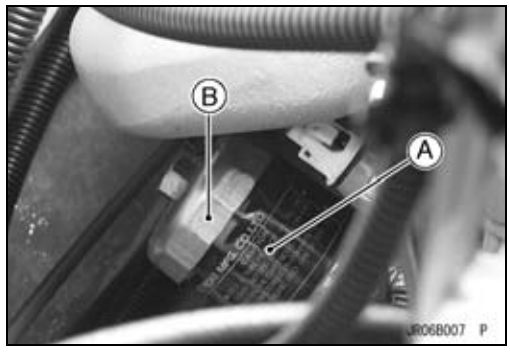
● Install the filler cap.

Torque - Oil Filler Cap: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)

● Check the oil level (see Oil Level Inspection in the Engine Lubrication System chapter).

Oil Filter Replacement

● Remove:
Seat (see Seat Removal in the Hull/Engine Hood chapter)
● Drain the engine oil (see Engine Oil Change).
● Disconnect the following to make service easy.
Air Bypass Hoses (Air Box Side)
Fuel Hose (Delivery Pipe Side)
Inlet Air Temperature Sensor Connector
● Place a rag or cloth under the oil filter to receive the remaining oil.
● Remove the oil filter [A] with the oil filter wrench [B].



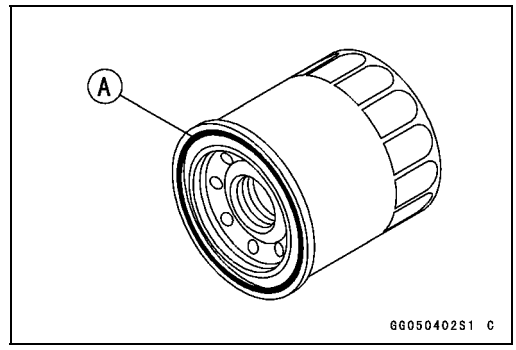
Special Tool - Oil Filter Wrench: 57001-1249

Periodic Maintenance Procedures

- Replace the filter with a new one.
- Apply engine oil to the gasket [A] before installation.
- Tighten the filter with the oil filter wrench.

Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)

- Pour in the specified type and amount of oil (see Engine Oil Change).



Engine Top End

Air Suction Valve Inspection (JT1500B7F Model)

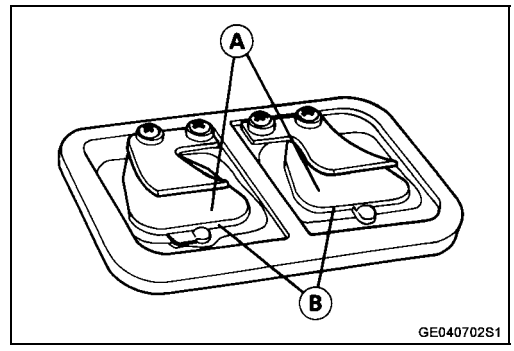
- Remove the air suction valve (see Air Suction Valve Removal in the Engine Top End chapter).
- Visually inspect the reeds [A] for cracks, folds, warps, heat damage, or other damage.

★If there is any doubt as to the condition of the reed, replace the air suction valve as an assembly.

- Check the reed contact areas [B] of the valve holder for grooves, scratches, any signs of separation from the holder, or heat damage.

★If there is any doubt as to the condition of the reed contact areas, replace the air suction valve as an assembly.

★If any carbon or other foreign particles have accumulated between the reed and the reed contact area, wash the valve assembly with a high-flash point solvent.



CAUTION

Do not scrape off the deposits with a scraper as this could damage the rubber, requiring replacement of the suction valve assembly.

Valve Clearance Inspection

NOTE

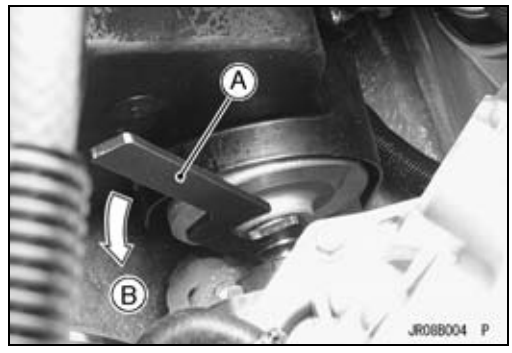
○*Valve clearance must be checked and adjusted when the engine is cold (at room temperature).*

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Air Box (see Air Box Removal in the Fuel (DFI) System chapter)
  Cylinder Head Cover (see Cylinder Head Cover Removal in the Engine Top End chapter)
- Position the crankshaft at #1, #4 piston TDC as follows.

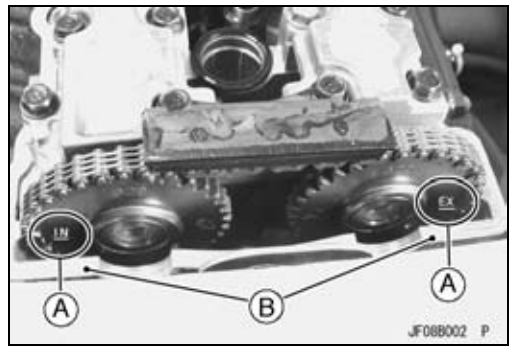
Periodic Maintenance Procedures

○Using the shaft wrench [A], turn the crankshaft counterclockwise [B] and set the crankshaft at #1, 4 piston TDC.

Special Tool - Shaft Wrench: 57001-1551

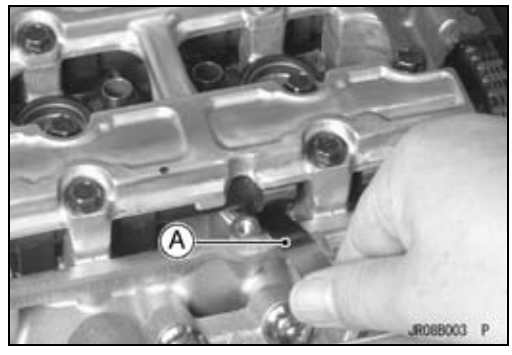


○The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown.

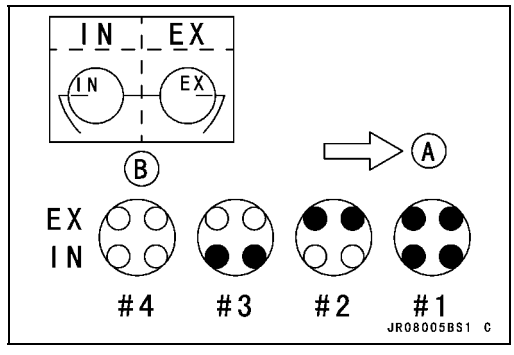


● Measure the valve clearance between the cam and the valve lifter with a thickness gauge [A].

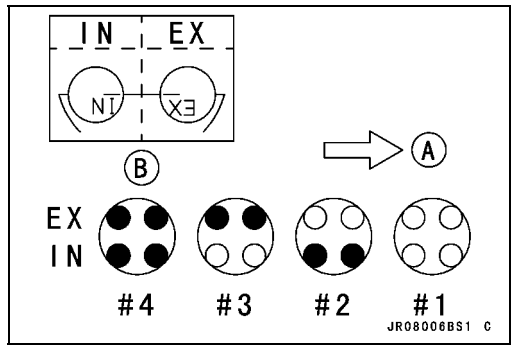
Valve Clearance
Standard:
IN 0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)
EX 0.32 ~ 0.41 mm (0.0126 ~ 0.0161 in.)



○**When positioning #1 piston TDC at the end of the compression stroke:**
Inlet Valve Clearance of #1 and #3 Cylinders
Exhaust Valve Clearance of #1 and #2 Cylinders
Measuring Valve [●]
Bow [A]
Camshaft Sprocket Position [B]



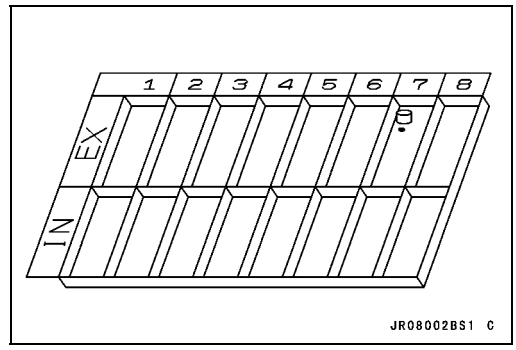
○**When positioning #4 piston TDC at the end of the compression stroke:**
Inlet Valve Clearance of #2 and #4 Cylinders
Exhaust Valve Clearance of #3 and #4 Cylinders
Measuring Valve [●]
Bow [A]
Camshaft Sprocket Position [B]



★If the valve clearance is not within the specified range, first record the clearance, and then adjust it.

Periodic Maintenance Procedures

● To change the valve clearance, remove the camshaft chain tensioner, camshafts and valve lifters. Replace the shim with one of a different thickness.



NOTE

○*Mark and record the valve lifter and shim locations so they can be reinstalled in their original positions.*

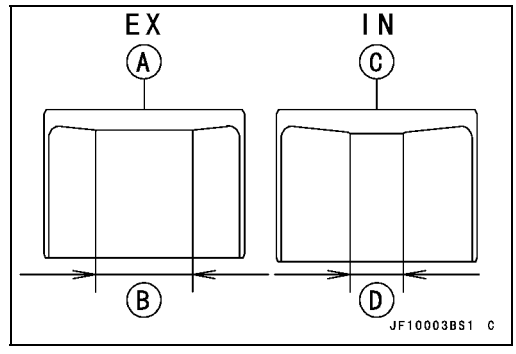
○*If there is no clearance, select a shim which is several sizes smaller and then measure the clearance.*

NOTE

○*For the EX valve lifters, JT1500B has larger size boss.*

EX Valve Lifters [A] : Boss diameter is larger [B]

IN Valve Lifters [C] : Boss diameter is smaller [D]



● To select a new shim which brings the valve clearance within the specified range, refer to the Valve Clearance Adjustment Charts.

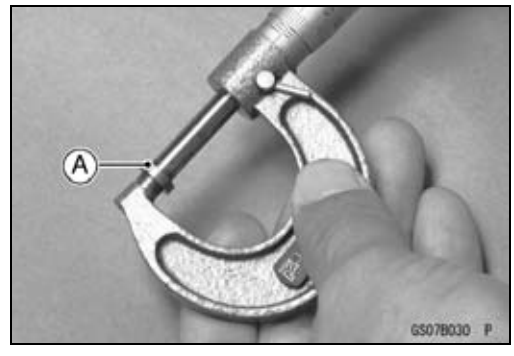
○Bisides the standard shims in the valve clearance adjustment charts, the following additional shims maybe used.

Adjustment Shims

Part Number	Thickness
92025-1982	2.425 mm
92025-1983	2.475 mm
92025-1984	2.525 mm
92025-1985	2.575 mm
92180-1058	2.375 mm
92180-1059	2.625 mm
92180-1194	2.675 mm
92180-1195	2.725 mm
92180-1196	2.775 mm

● Clean the shim to remove any dust or oil.

● Measure the thickness of the removed shim [A].



Periodic Maintenance Procedures

INLET VALVE CLEARANCE ADJUSTMENT CHART

	Present Shim (Example)																				
Part No. (92025)	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
Mark	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	00
Thickness (mm)	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00

Valve Clearance Measurement (mm) (Example)																					
0.00 ~ 0.02	—	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80
0.03 ~ 0.06	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85
0.07 ~ 0.11	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90
0.12 ~ 0.14	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
0.15 ~ 0.24	Specified Clearance / No Change Required																				
0.25 ~ 0.27	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
0.28 ~ 0.32	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00		
0.33 ~ 0.37	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00			
0.38 ~ 0.42	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00				
0.43 ~ 0.47	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00					
0.48 ~ 0.52	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00						
0.53 ~ 0.57	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00							
0.58 ~ 0.62	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00								
0.63 ~ 0.67	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00									
0.68 ~ 0.72	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00										
0.73 ~ 0.77	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00											
0.78 ~ 0.82	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00												
0.83 ~ 0.87	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00													
0.88 ~ 0.92	2.70	2.75	2.80	2.85	2.90	2.95	3.00														
0.93 ~ 0.97	2.75	2.80	2.85	2.90	2.95	3.00															
0.98 ~ 1.02	2.80	2.85	2.90	2.95	3.00																
1.03 ~ 1.07	2.85	2.90	2.95	3.00																	
1.08 ~ 1.12	2.90	2.95	3.00																		
1.13 ~ 1.17	2.95	3.00																			
1.18 ~ 1.22	3.00																				

Install the shim of this thickness (mm).

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

Example

Present shim is **2.60 mm**.
Measured clearance is **0.35 mm**.
Replace **2.60 mm** shim with **2.75 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

Periodic Maintenance Procedures

EXHAUST VALVE CLEARANCE ADJUSTMENT CHART

	Present Shim													Example							
Part No. (92025)	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
Mark	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	00
Thickness (mm)	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00

Valve Clearance Measurement (mm)																					
0.00~0.04	–	–	–	–	–	–	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65
0.05~0.09	–	–	–	–	–	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70
0.10~0.14	–	–	–	–	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75
0.15~0.19	–	–	–	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80
0.20~0.24	–	–	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85
0.25~0.29	–	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90
0.30~0.31	–	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
0.32~0.41	Specified Clearance/No Change Required																				
0.42~0.44	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
0.45~0.49	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00		
0.50~0.54	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00			
0.55~0.59	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00				
0.60~0.64	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00					
0.65~0.69	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00						
0.70~0.74	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00							
0.75~0.79	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00								
0.80~0.84	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00									
0.85~0.89	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00										
0.90~0.94	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00											
0.95~0.99	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00												
1.00~1.04	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00													
1.05~1.09	2.70	2.75	2.80	2.85	2.90	2.95	3.00														
1.10~1.14	2.75	2.80	2.85	2.90	2.95	3.00															
1.15~1.19	2.80	2.85	2.90	2.95	3.00																
1.20~1.24	2.85	2.90	2.95	3.00																	
1.25~1.29	2.90	2.95	3.00																		
1.30~1.34	2.95	3.00																			
1.35~1.39	3.00																				

Example

Install the shim of this thickness (mm).

JR08011BW3 C

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect. This shim will give the proper clearance.

Example

Present shim is **2.65 mm**.
Measured clearance is **0.42 mm**.
Replace **2.65 mm** shim with **2.80 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

Periodic Maintenance Procedures

- Apply molybdenum disulfide oil to the valve lifters and apply engine oil to the shims, and install them.
- Install the camshafts. Be sure to install the camshafts properly (see Camshaft Installation in the Engine Top End chapter).
- Remeasure any valve clearance that was adjusted.
- Readjust if necessary.

CAUTION

Do not put shim stock under the shim. This may cause the shim to pop out at high rpm, causing extensive engine damage.
Do not grind the shim. This may cause it to fracture, causing extensive engine damage.

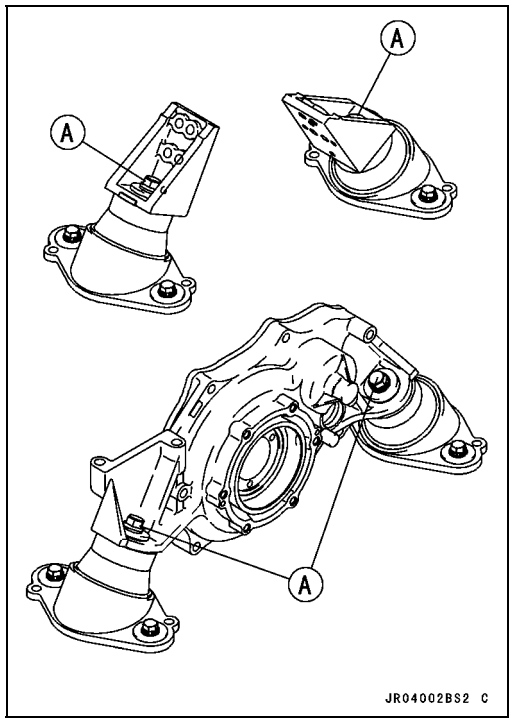
Engine Mounting Bolts Inspection and Tightness

- Check the tightness of the engine mounting bolts [A].

★If there are loose bolts, remove the bolts.

- Apply a non-permanent locking agent to the engine mounting bolts and tighten them.

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)



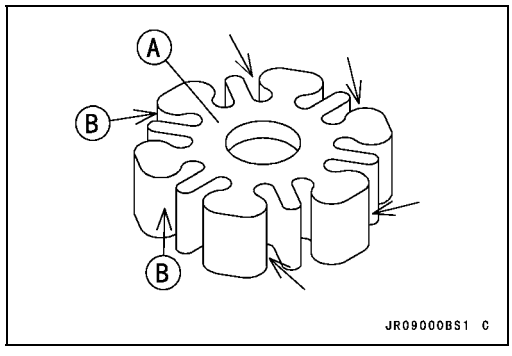
Engine Bottom End

Coupling Damper Inspection

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Engine (see Engine Removal in the Engine Removal/Installation chapter)
- Remove the coupling damper [A] and inspect it for wear [B] and deterioration.

★If it is grooved or misshapen, replace it with a new damper.

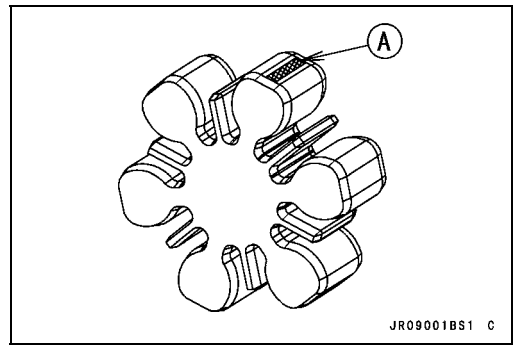
★If there is any doubt as to coupler condition, replace it.



Periodic Maintenance Procedures

NOTE

○*The JT1500B has the damper with white mark [A].*



Cooling and Bilge Systems

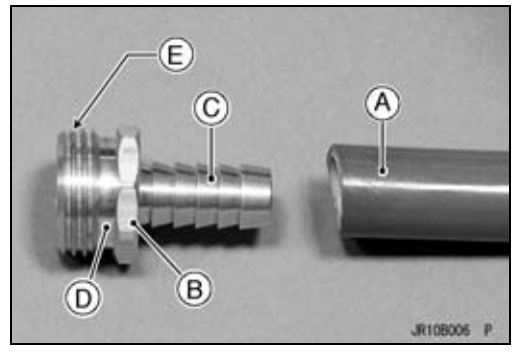
Cooling System Flushing

To prevent sand or salt deposits from accumulating in the cooling system, it must be flushed occasionally. Flush the system according to the Periodic Maintenance Chart, after each use in salt water, or whenever there is reduced water flow from the bypass outlet on the right side of the hull.

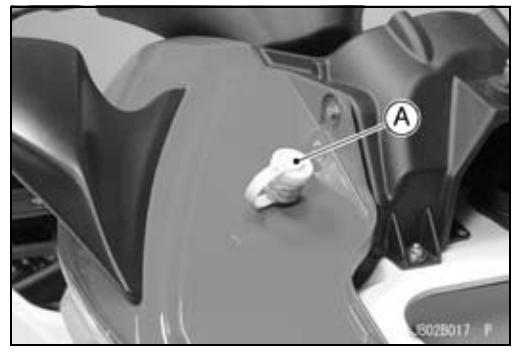
- Obtain a standard garden hose [A] and a garden hose adapter [B] as shown.
  Garden Hose Fitting of Adapter [C]
  Flushing Fitting of Adapter [D]
  Thread: Rp 3/4 [E]

NOTE

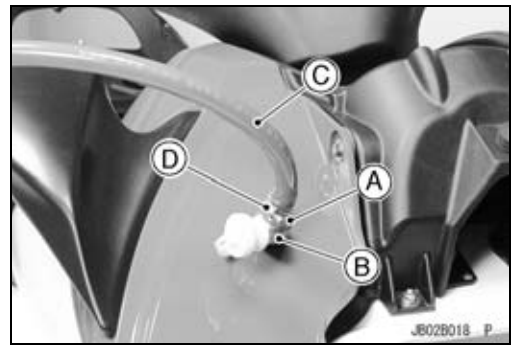
○*Optional part (P/No. 92005-3746) is available as a garden hose adapter.*



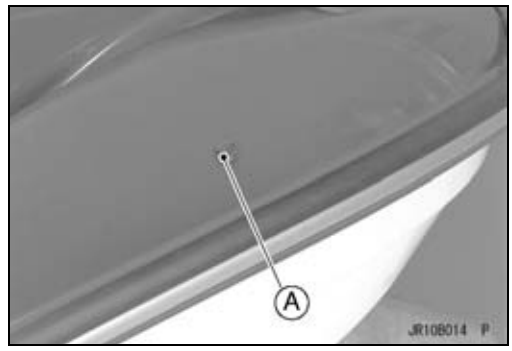
- Open the front storage compartment cover (see Front Storage Compartment Cover Removal).
- Remove the flushing cap [A] on the brim of the engine compartment.



- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].



- Start the engine and allow it to idle before turning on the water.



CAUTION
The engine must be running before the water is turned on or water may flow back through the exhaust pipe into the engine, resulting in the possibility of severe internal damage.

- Immediately turn on the water and adjust the flow so that a little trickle of water comes out of the bypass outlet [A] on the right side of the hull.
- Leave the engine idle for several minutes with the water running.
- Turn off the water. Leave the engine idling.
- Rev the engine a few times to clear the water out of the exhaust system.

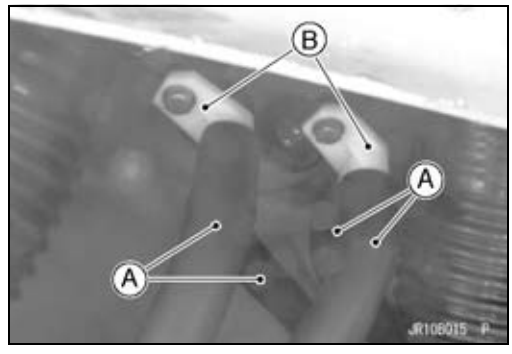
CAUTION
Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

- Switch off the engine, remove the garden hose and the adapter.
- Install the flushing cap securely.

Bilge System Flushing

To prevent clogging, the bilge system should be flushed out according to the Periodic Maintenance Chart, or whenever you suspect it is blocked.

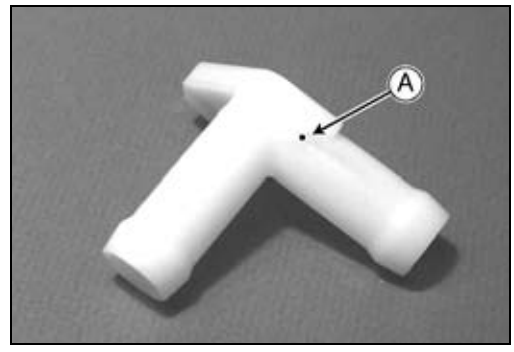
- Disconnect both bilge hoses [A] at the plastic breather fitting [B].



- Connect the bilge filter hoses (from the hull bottom) to the garden hoses, turn the water on, and flush it out for about a minute. During this procedure, water will flow into the engine compartment. Do not allow a large amount of water to accumulate in the engine compartment. Remove the drain screws in the stern to drain the engine compartment.
- Connect the other hoses (from the hull bulkhead) to the garden hose, turn the water on, and flush it out for several minutes.

Periodic Maintenance Procedures

- Before reconnecting the hoses to the plastic breather fitting make sure the small hole [A], on top of the breather fitting is clear.
- Reconnect the bilge hoses.



Pump and Impeller

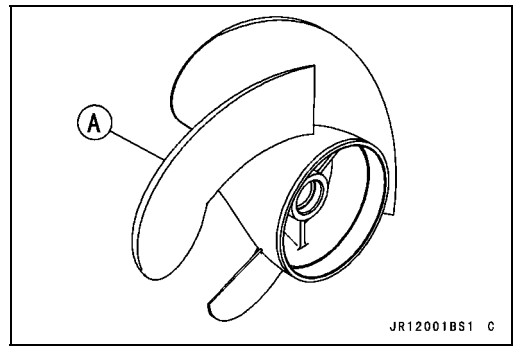
Impeller Inspection

- Examine the impeller. [A]

★If there is pitting, deep scratches, nicks or other damage, replace the impeller.

NOTE

○*Minor nicks and gouges in the impeller blades can be removed with abrasive paper or careful filing. Smooth leading edges are especially important to avoid cavitation.*



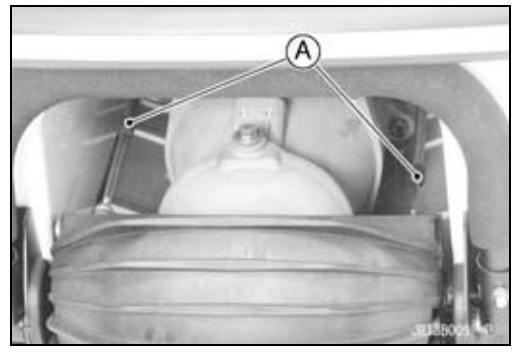
Steering

Steering Cable/Shift Cable Inspection

- Examine the steering cable or shift cable.

★If each cable or cable housing is kinked or frayed, replace the cables.

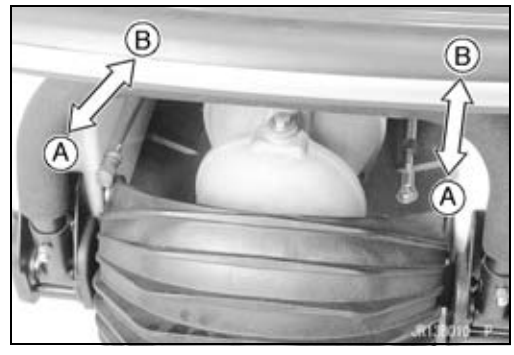
★If the each seal [A] at either end of each cable is damaged in any way, replace the cables.



- Be certain that each cable moves freely in both directions.
- Disconnect the cable joints at each end of each cable.

○Take out the cable joint bolt or ball joint and disconnect the cable joint.

CAUTION
Never lay the watercraft on the right side. Water in the exhaust system may drain back into the engine causing serious damage.

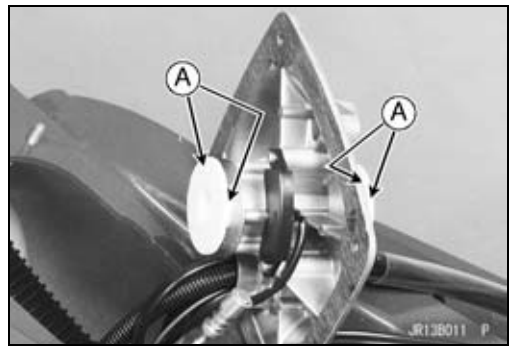


○Slide the inner cable back [A] and forth [B] in each cable housings.

★If each cable does not move freely, replace it.

Periodic Maintenance Procedures

Handlebar Pivot Lubrication



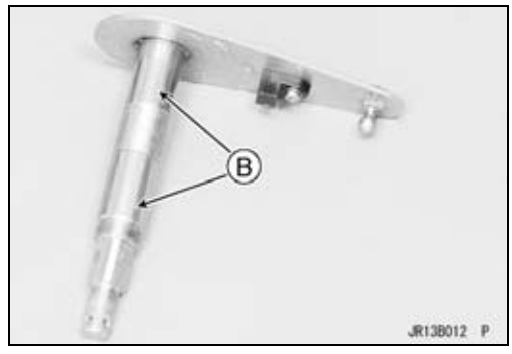
- Check the bushings for damage and wear.

★If the bushings are damaged or worn, replace them.

- Grease:

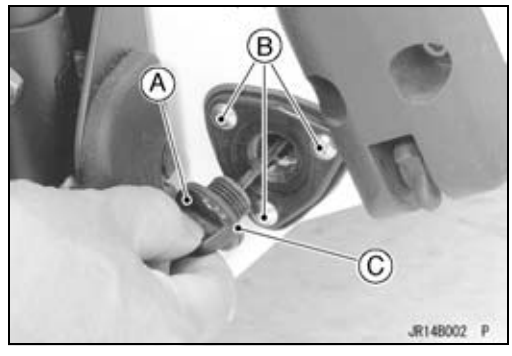
  Bushings [A]

  Steering Shaft [B]



Hull/Engine Hood

Drain Plug Inspection



- Check the drain plugs [A] for cracks or damage and make sure the drain plug mounting screws [B] are tightened securely.
- Check the seals [C] for damage.

★If necessary, replace the drain plugs or seals.

Periodic Maintenance Procedures

Electrical System

Battery Charging Condition Inspection

Battery charging condition can be checked by measuring battery terminal voltage.

- Disconnect the battery terminal cables (see Battery Removal in the Electrical System chapter).

CAUTION

Be sure to disconnect the negative terminal cable first.

- Measure the battery terminal voltage.

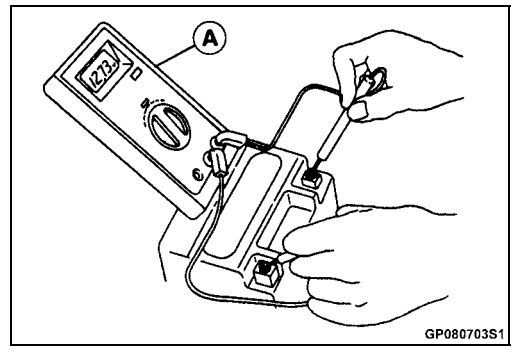
NOTE

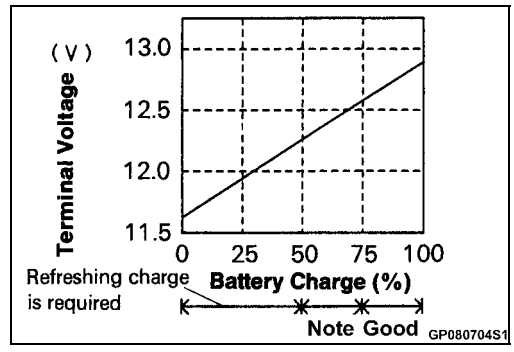
○*Measure with a digital voltmeter [A] which can be read one decimal place voltage.*

★If the reading is below the specified, refreshing charge is required (see Refreshing Charge in the Electrical System chapter).

Battery Terminal Voltage
Standard: 12.8 V or more

- Connect the battery cables, positive first.



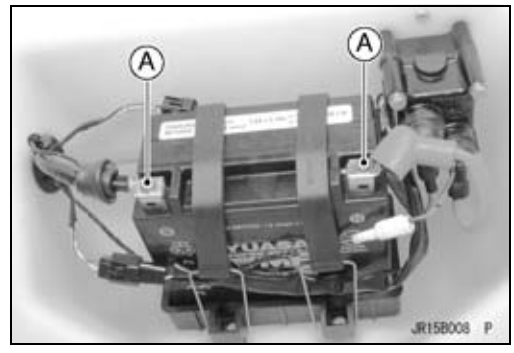


Battery Terminals Inspection

- Check the battery terminal screws [A] for tightness and make sure the terminal covers are in place.

⚠ WARNING

Loose battery cables can create sparks which can cause a fire or explosion resulting in injury or death. Make sure the battery terminal screws are tightened securely and the covers are installed over the terminals.

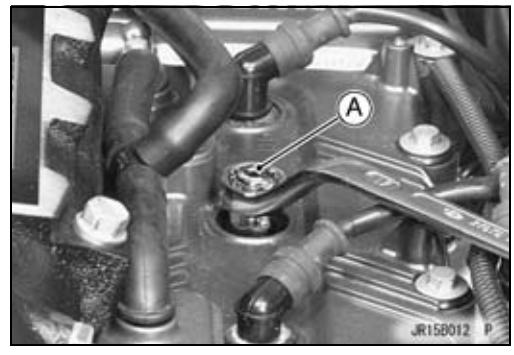


- Check that the battery terminals are not corroded.
- ★If necessary, remove the battery (see Battery Removal in the Electrical System chapter) and clean the terminals and cable ends using a solution of baking soda and water.
- After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.
- Install the battery (see Battery Installation in the Electrical System chapter).

Spark Plug Inspection

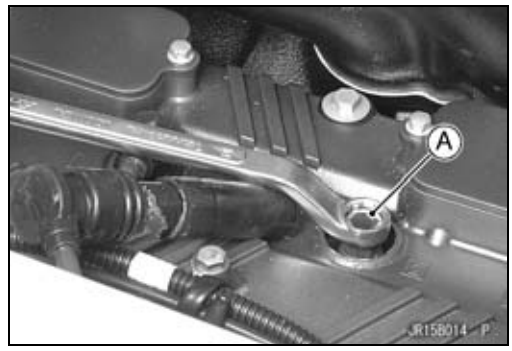
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Spark Plug Caps
- Remove the spark plugs using the 16 mm plug wrench [A].

Owner's Tool - Spark Plug Wrench, 16 mm: 92110-3706



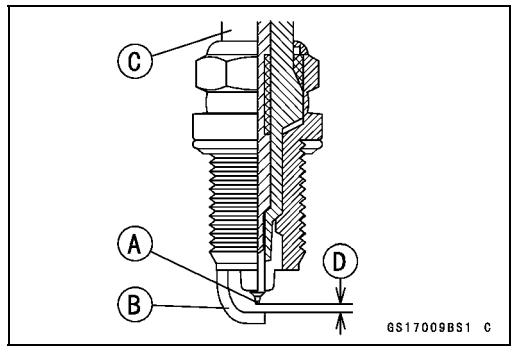
Periodic Maintenance Procedures

● JT1500B8F Model



● Visually inspect the spark plugs.
★If the spark plug center electrode [A] and/or side electrode [B] are corroded or damaged, or if the insulator [C] is cracked, replace the plug.
● Measure the gaps [D] with a wire-type thickness gauge.
★If the gap is incorrect, replace the spark plug.

Spark Plug Gap: 0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)



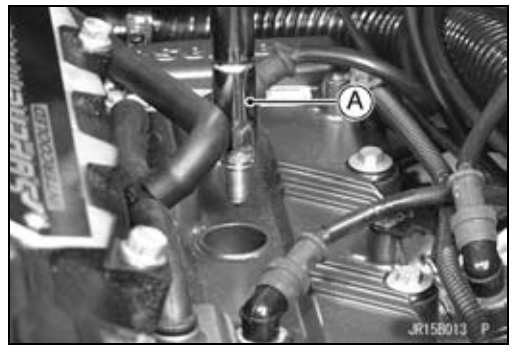
● Insert the spark plug vertically into the plug hole with the spark plug installed in the plug wrench [A].

Owner's Tool - Spark Plug Wrench, 16 mm: 92110-3706

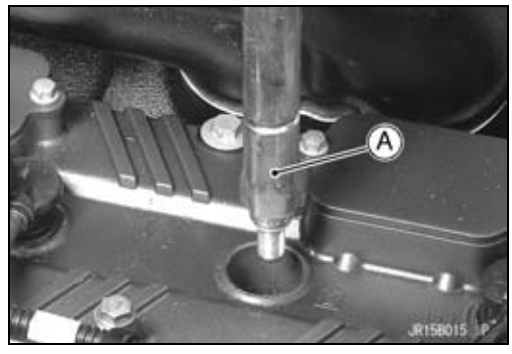
● Tighten:

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)

● Be sure to install the plug caps so that the plug cap leads are positioned at a right angle to the engine center line (see Cable, Wire and Hose Routing section in the Appendix chapter).



● JT1500B8F Model

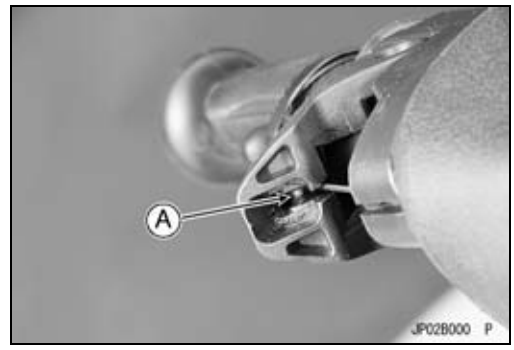


Lubrication

As in all marine craft, adequate lubrication and corrosion protection is an absolute necessity to provide long, reliable service. Refer to the Periodic Maintenance Chart for the frequency of the following items:

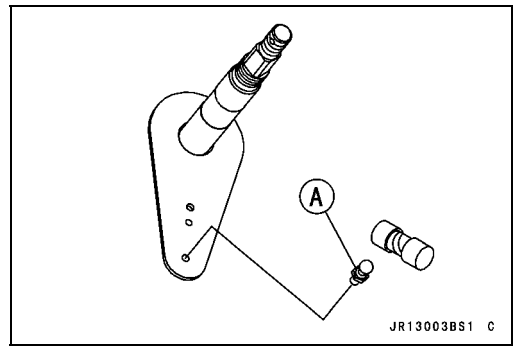
Periodic Maintenance Procedures

● Lubricate the following with grease.
○Pull the throttle lever and hold it.
Throttle Cable End [A] at Throttle Lever

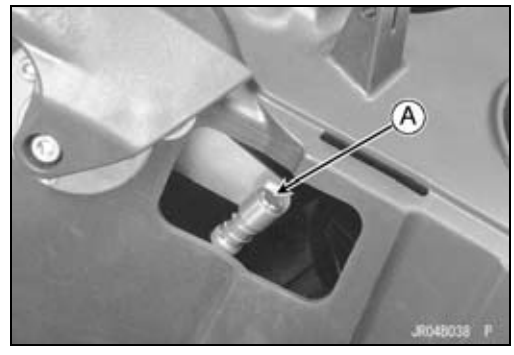


Throttle Cable End [A] at Throttle Body

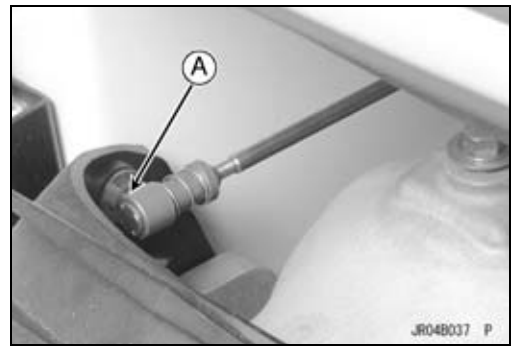
○Remove the steering cover (see Steering Cover Removal in the Hull/Engine Hood chapter).
Steering Cable Ball Joint [A] at Steering Shaft



○Remove the left side cover (see Side Cover Removal in the Hull/Engine Hood chapter).
Shift Cable Ball Joint [A] at Reverse Lever

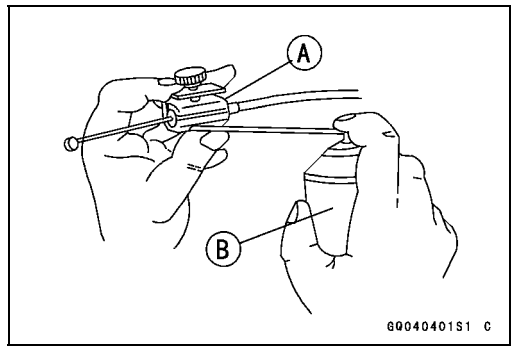


Shift Cable Ball Joint [A] at Reverse Bucket

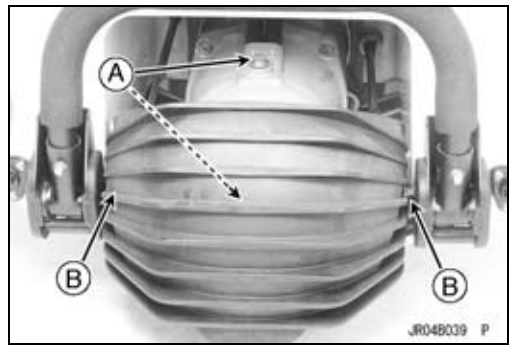


Periodic Maintenance Procedures

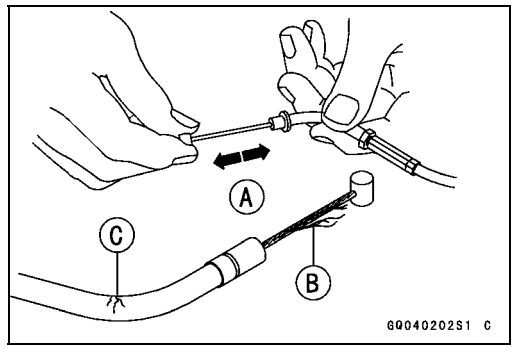
● Lubricate the following with a penetrating rust inhibitor [B].
Throttle Cable [A]



Steering Nozzle Pivots [A]
Reverse Bucket Pivots [B]



● With the cable disconnected at both ends, the cable should move freely [A] within the cable housing.
★If cable movement is not free after lubricating, if the cable is frayed [B], or if the cable housing is kinked [C], replace the cable.



Periodic Maintenance Procedures

All Hoses, Hose Clamps, Nuts, Bolts and Fasteners Check

Nuts, Bolts, and Fasteners Tightness Inspection

● Check the tightness of the bolts and nuts listed here. Also, check to see that each cotter pin is in place and in good condition.

NOTE

○*For the engine fasteners, check the tightness of them when the engine is cold (at room temperature).*

★If there are loose fasteners, retighten them to the specified torque following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not in the appropriate chapter, see the Standard Torque Table. For each fastener, first loosen it by 1/2 turn, then tighten it.

★If cotter pins are damaged, replace them with new ones.

Nut, Bolt and Fastener to be checked

Engine:
- Oil Filter Cartridge
- Engine Mounting Bolts (and bracket bolts)
- Engine Damper Mounting Bolts
- Cylinder Head Cover Bolts
- Cylinder Head Bolts

Drive Shaft, Pump, and Impeller:
- Drive Shaft Holder Mounting Bolts
- Pump Mounting Bolts
- Pump Cover Mounting Bolts
- Pump Grate Mounting Bolts
- Steering Nozzle Pivot Bolts
- Reverse Bucket Pivot Bolts

Steering:
- Handlebar Clamp Bolts
- Steering Neck Mounting Bolts
- Steering Holder Mounting Bolts
- Steering Shaft Locknut
- Steering Cable Nut
- Steering Cable Joint Bolt
- Shift (reverse) Cable Nut

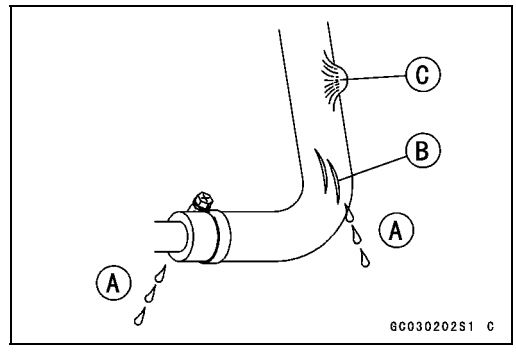
Hull and Engine Hood:
- Stabilizer Mounting Bolts
- Rear Grip Plate Mounting Bolts

Electrical System:
- Spark Plugs
- Battery Terminal

Hose and Hose Connect Inspection

● Check the following hoses for leakage [A], hardening, cracking [B], checking, cuts, abrasions, breaks and bulges [C]. And make sure the hoses are not kinked or pinched.
- Fuel Vent Hose
- Oil Hoses
- Cooling Hoses
- Bilge Hoses

★If a hose is damaged in any way, replace it immediately and check all the others for damage.

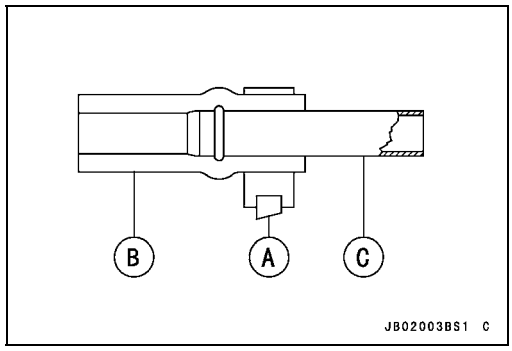


Periodic Maintenance Procedures

● Make sure the above hoses are routed properly and secured with the clamps away from any moving parts and sharp edged portions.
Plastic Clamp [A]
Hose [B]
Hose Fitting [C]

NOTE

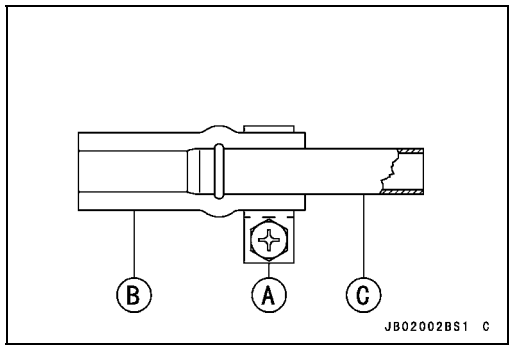
○*The majority of bilge hoses have no clamps at the hose ends.*



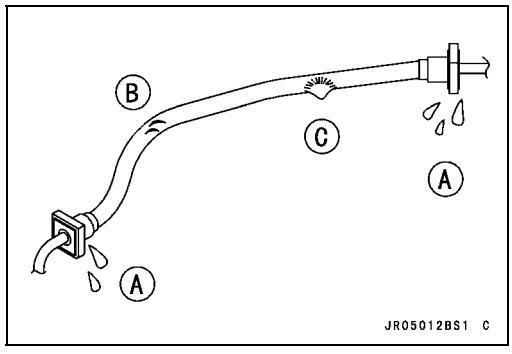
Metal Clamp [A]
Hose [B]
Hose Fitting [C]

NOTE

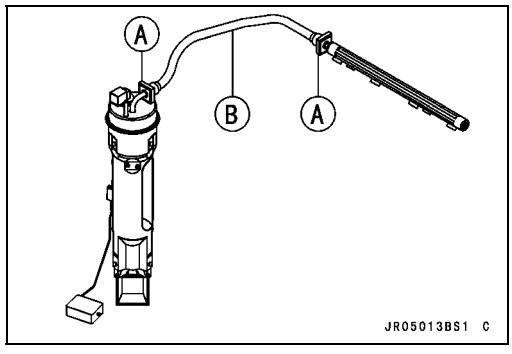
○*Check the fuel and exhaust tubes for signs of wear, deterioration, damage or leakage. Replace if necessary.*
○*Make sure the above tubes are secured with the metal gear clamps away from any parts.*



● If the watercraft is not properly handled, the high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Remove the seat (see Seat Removal in the Hull/Engine Hood chapter) and check the fuel hose.
★Replace the fuel hose if any fraying, cracks [B] or bulges [C] are noticed.



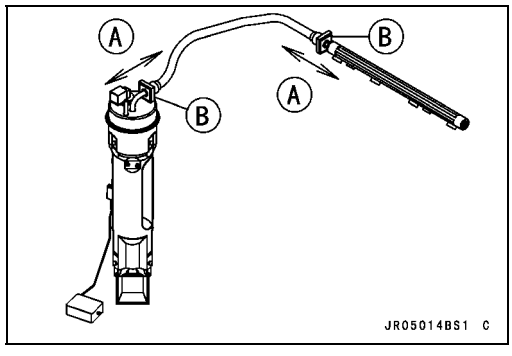
● Check that the hoses are routed according to Cable, Wire, and Hose Routing section in the Appendix chapter.
★Replace the hose if it has been sharply bent or kinked.
Hose Joints [A]
Fuel Hose [B]



● Check that the hose joints are securely connected.
○Push and pull [A] the hose joint [B] back and forth more than two times, and make sure it is locked.
★If it does not locked, reinstall the hose joint.

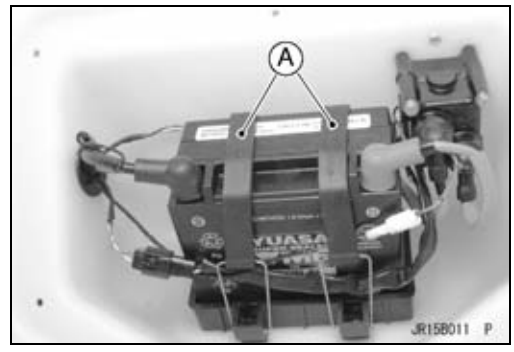
⚠ WARNING

Make sure the hose joint is installed correctly on the delivery pipe by sliding the joint, or the fuel could leak.



Periodic Maintenance Procedures

Rubber Strap Inspection



- Check the following rubber straps for any deterioration or damage. Pull on squeeze the straps and look for cracks.
  Battery Straps [A]
  Fuel Tank Straps
  Water Box Muffler Straps

★If a strap is damage in any way, replace it.

Fuel System (DFI)

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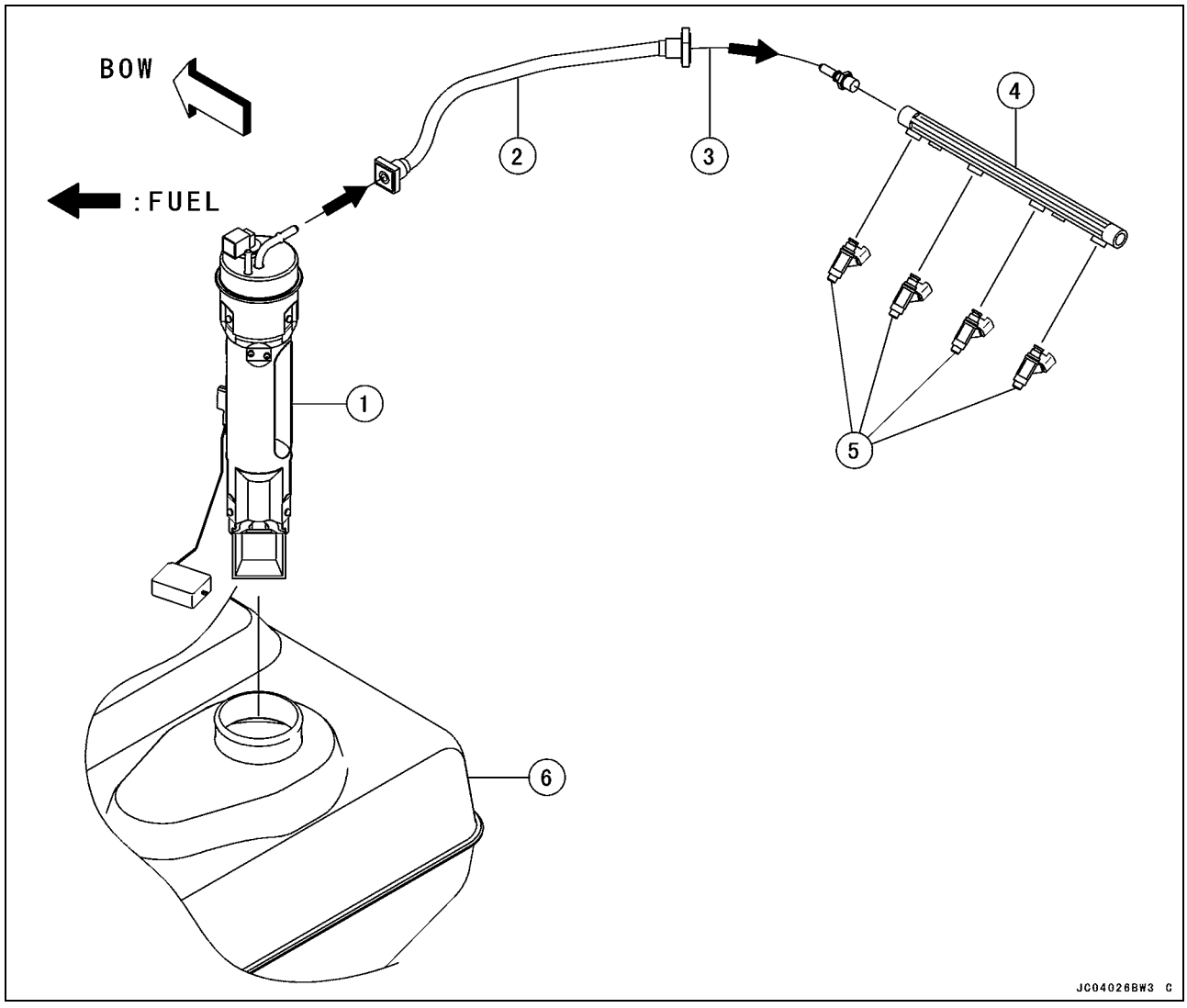
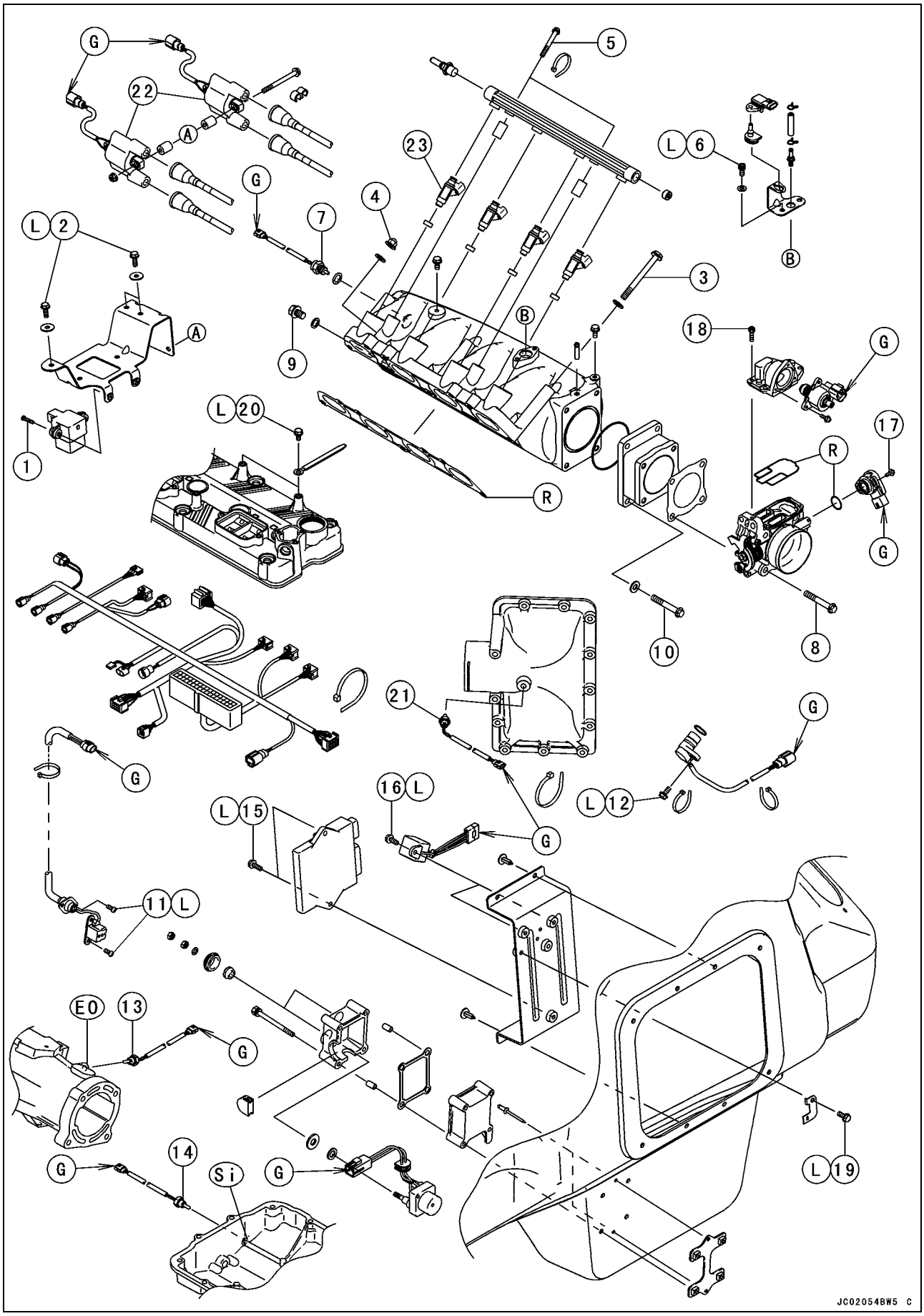
Fuel System Diagram



1. Fuel Pump
2. Fuel Hose
3. Supply Line
4. Delivery Pipe
5. Fuel Injectors
6. Fuel Tank

Exploded View



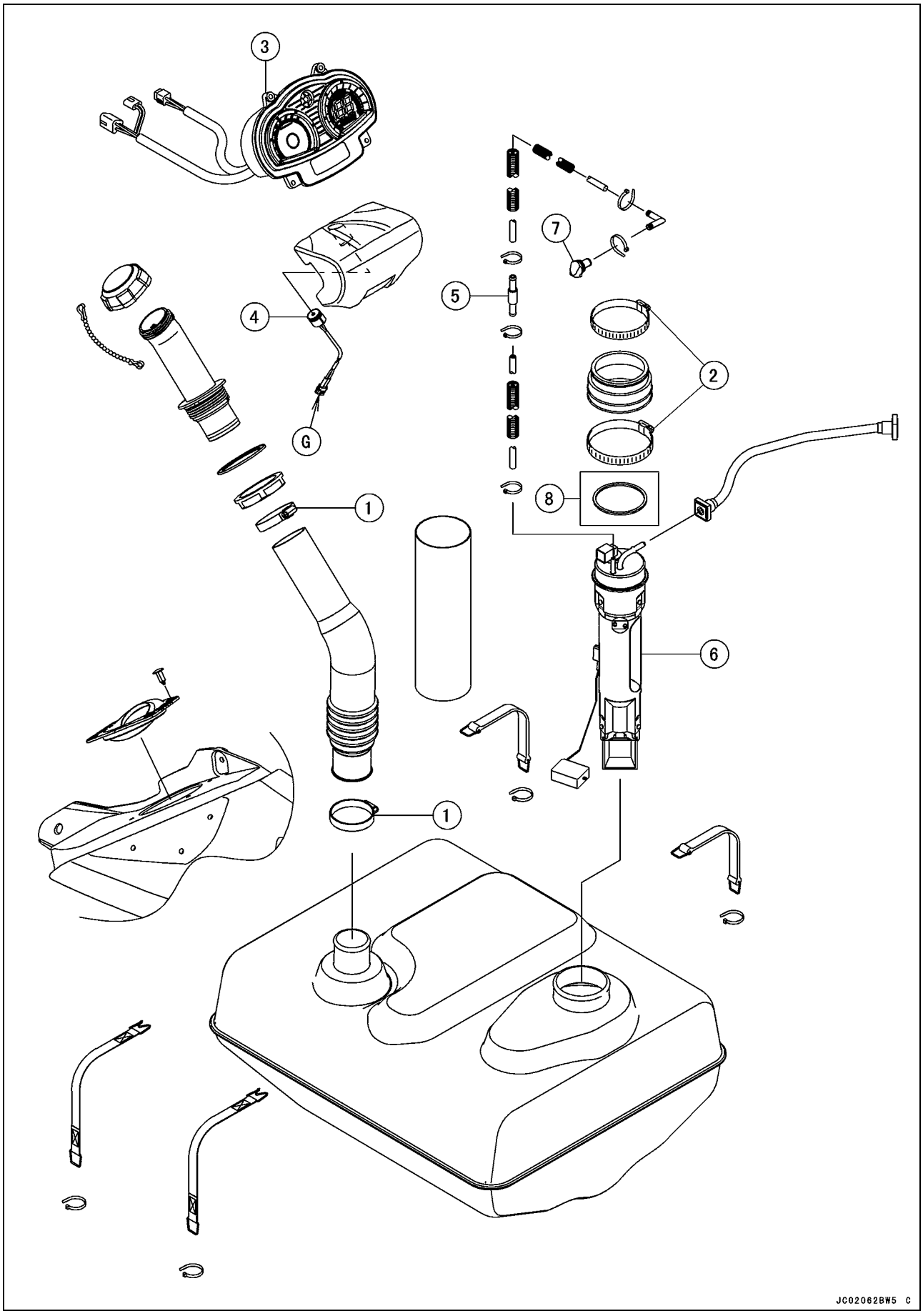
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
2	Bracket Mounting Bolts	8.8	0.90	78 in·lb	L
3	Inlet Manifold Mounting Bolts	25	2.5	18	
4	Inlet Manifold Mounting Nuts	20	2.0	14	
5	Delivery Pipe Mounting Bolts	7.8	0.80	69 in·lb	
6	Inlet Air Pressure Sensor Bracket Bolts	8.8	0.90	78 in·lb	L
7	Inlet Air Temperature Sensor	20	2.0	14	
8	Throttle Body Assy Mounting Bolts	20	2.0	14	
9	Inlet Manifold Drain Plug	20	2.0	14	
10	Throttle Body Assy Damper Bolts	20	2.0	78 in·lb	
11	Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
12	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
13	Water Temperature Sensor	15	1.5	11	see text
14	Oil Temperature Sensor	15	1.5	11	see text
15	ECU Mounting Bolts	3.0	0.3	27 in·lb	L
16	Relay Bolts	2.5	0.25	22 in·lb	L
17	Throttle Sensor Mounting Screws	2.0	0.20	18 in·lb	
18	ISC Actuator Mounting Bolts	4.9	0.50	43 in·lb	
19	Fuse Bracket Bolt	2.5	0.25	22 in·lb	L
20	Harness Bolts	8.8	0.90	78 in·lb	L
21	Charging Temperature Sensor	15	1.5	11	

22. Ignition Coils
23. Fuel Injectors

EO: Fill the hollow with the engine oil (10W-30).
G: Apply grease.
L: Apply a non-permanent locking agent.
R: Replacement Parts
Si: Fill the hollow with the specified silicone grease (Kawasaki Bond: 92137-1002).

Exploded View

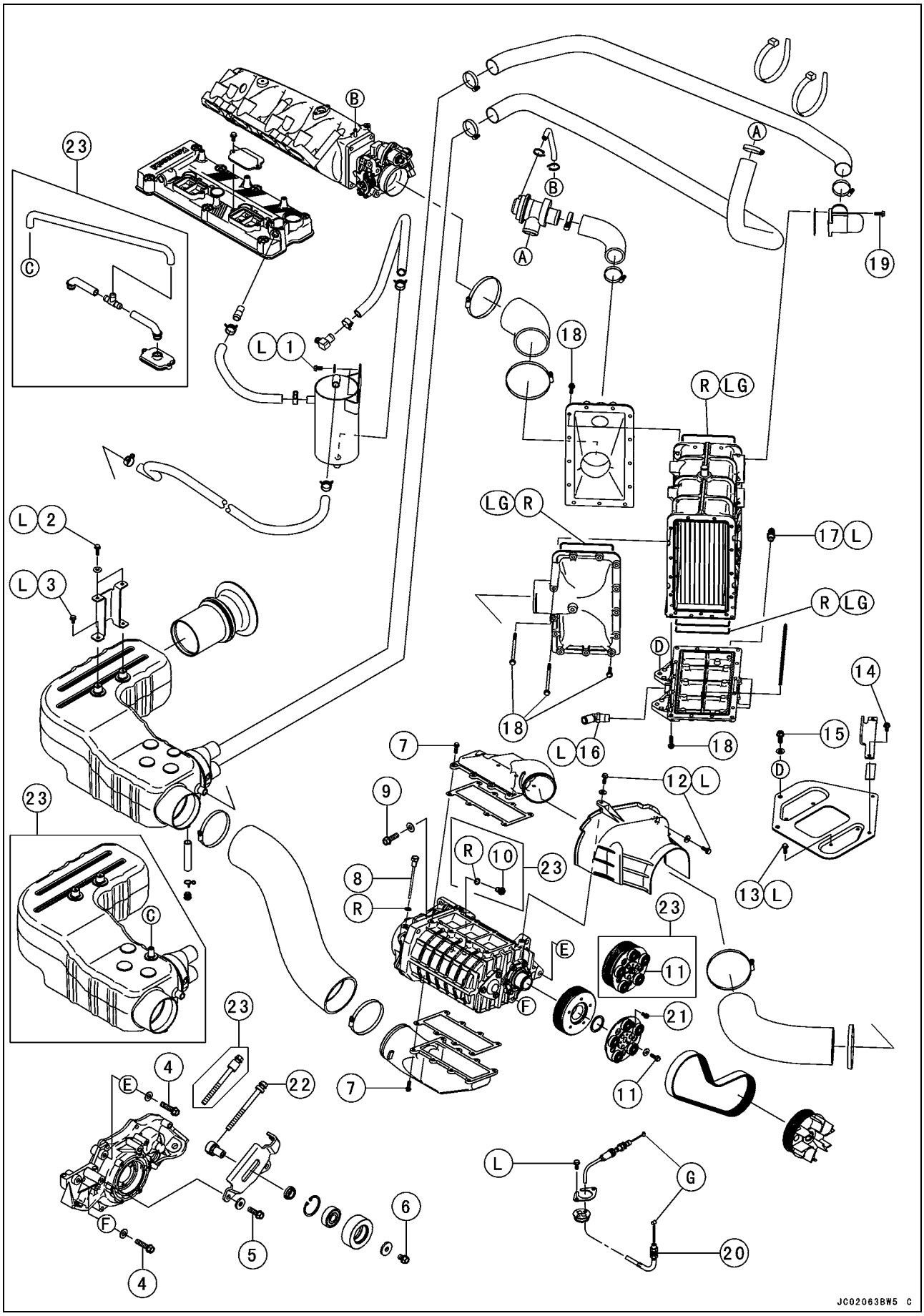


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Fuel Filler Tube Clamp Screws	2.9	0.30	26 in·lb	
2	Fuel Pump Holder Clamp Screws	2.9	0.30	26 in·lb	

3. Meter Unit
4. Buzzer
5. Fuel Vent Check Valve
6. Fuel Pump
7. Install the grommet so that the hole of the grommet comes downward.
8. JT1500B7F Model

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Separator Tank Mounting Bolts	8.8	0.90	69 in·lb	L
2	Air Box Bracket Bolts	8.8	0.90	69 in·lb	L
3	Air Box Bolts	8.8	0.90	69 in·lb	L
4	Rear Supercharger Bolts	45	4.6	33	
5	Belt Tensioner Plate Bolts	45	4.6	33	
6	Idler Bolt	30	3.1	22	
7	Intake Pipe Bolts (IN/OUT)	7.8	0.80	69 in·lb	
8	Gear Oil Level Gauge	19	1.9	14	
9	Front Supercharger Bolts	45	4.6	33	
10	Drain Bolt	19	1.9	14	
11	Pulley Bolt	19	1.9	14	
12	Belt Cover Bolts	4.9	0.50	43 in·lb	L
13	Intercooler Plate Bolts	8.8	0.90	69 in·lb	L
14	Intercooler Bracket Bolts	7.8	0.80	69 in·lb	
15	Intercooler Mounting Bolts	30	3.1	22	
16	Water Hose Joint	11	1.1	95 in·lb	L
17	Water Hose Joint	20	2.0	14	L
18	Intercooler Cover Bolts	10	1.0	89 in·lb	
19	Blow off Valve Bolts	7.8	0.80	69 in·lb	
20	Throttle Cable Locknuts	20	2.0	14	
21	Pulley Plate Bolts	15	1.5	11	L
22	Belt Tension Adjuster	3.0	0.31	27 in·lb	

23. JT1500B7F Model
G: Apply grease.
L: Apply a non-permanent locking agent.
LG: Apply liquid gasket (Kawasaki Bond):92104-1063
R: Replacement Parts

Specifications

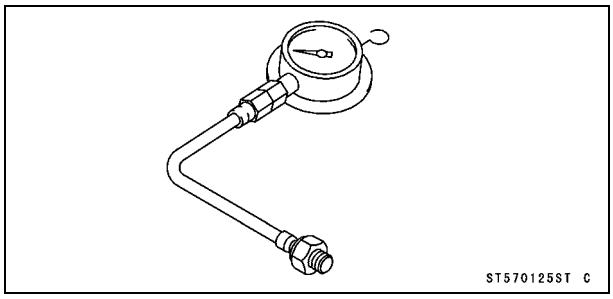
Item	Standard
Digital Fuel Injection System	
Idle Speed	1 300 ±100 r/min (rpm) - both in and out of water
Throttle Assy:	
Type	Single type
Bore	ϕ60 (2.36 in.)
ECU (Electronic Control Unit):	
Make	Mitsubishi Electric
Type	Digital memory type, with built in IC igniter, sealed with resin
Operating range	Engine speed range 100 ~ 8 100 r/min (rpm)
Fuel Pressure (High Pressure Line):	
Engine Idling	approx. 294 kPa (3.0 kgf/cm², 43 psi)
Fuel Pump:	
Type	Impeller type
Discharge	83 mL or more for 3 seconds
Throttle Sensor:	
Input Voltage	4.75 ~ 5.25 V DC between R and BK/W leads
Output Voltage	1.08 ~ 1.18 V DC between G/W and BK/W leads (at idle throttle opening)
Resistance	4 ~ 6 kΩ
Inlet Air Pressure Sensor:	
Input Voltage	4.75 ~ 5.25 V DC between R and BK/W leads
Output Voltage	3.75 ~ 4.25 V DC between G/R and BK/W leads at standard atmospheric pressure
Inlet Air Temperature Sensor:	
Output Voltage at ECU	about 2.3 ~ 2.6 V at 20°C (68°F)
Resistance	5.4 ~ 6.6 kΩ at 0°C (32°F) 2.26 ~ 2.86 kΩ at 20°C (68°F) 0.29 ~ 0.39 kΩ at 80°C (176°F)
Water Temperature Sensor:	
Resistance	see Electrical System chapter
Output Voltage at ECU	about 3 ~ 4 V at 20°C (68°F)
Vehicle-down Sensor:	
Detection Method	Magnetic flux detection method
Detection Angle	more than 110 ~ 130° for each bank
Output Voltage	with sensor tilted 110 ~ 130° or more: 0.65~ 1.35 V with sensor arrow mark pointed up: 3.55 ~ 4.45 V
Fuel Injectors:	
Type	INP-281
Nozzle Type	One spray type with 4 holes
Resistance	about 11.7 ~ 12.3 Ω at 20°C (68°F)
Oil Temperature Sensor:	
Resistance	same to water temperature sensor
Output Voltage at ECU	about 3 ~ 4 V at 20°C (68°F)

Specifications

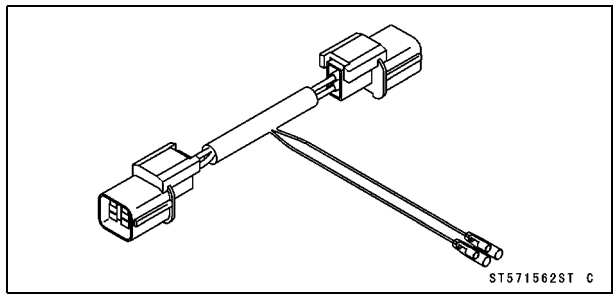
Item	Standard
Throttle Lever and Cables	
Throttle Lever Free Play	about 2 mm (0.08 in.)

Special Tools and Sealant

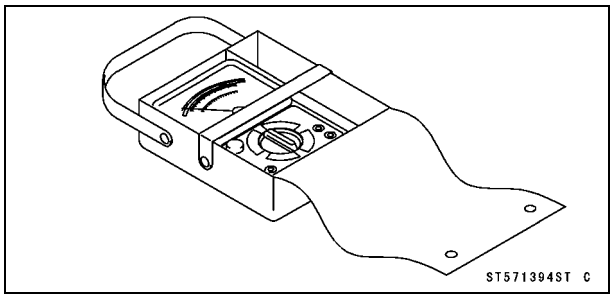
Oil Pressure Gauge, 5 kgf/cm²:
57001-125



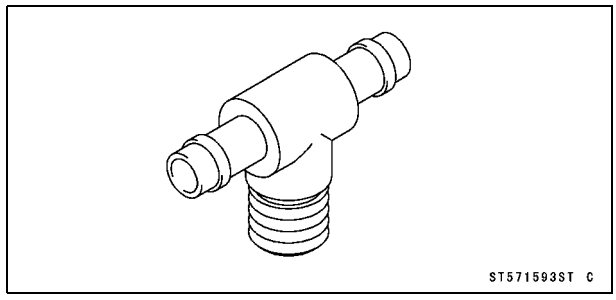
Harness Adapter:
57001-1562



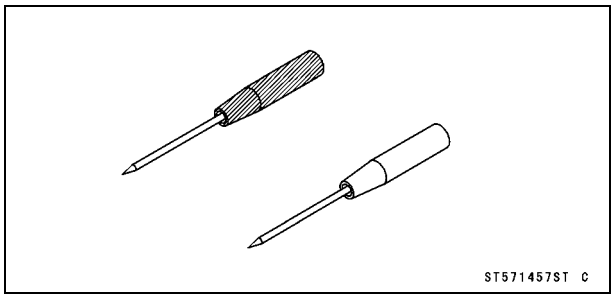
Hand Tester:
57001-1394



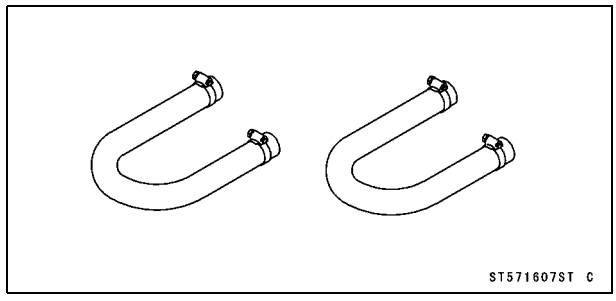
Fuel Pressure Gauge Adapter:
57001-1593



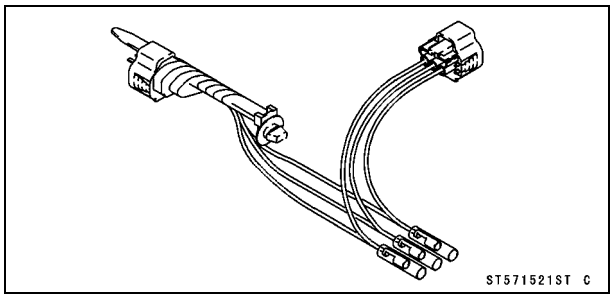
Needle Adapter Set:
57001-1457



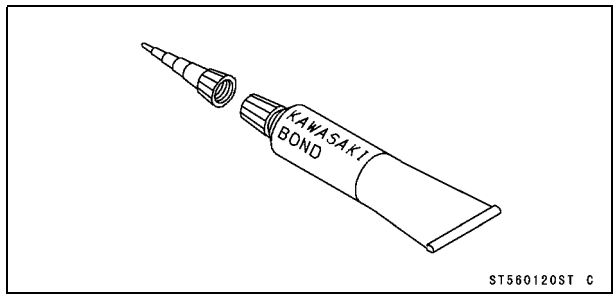
Fuel Hose:
57001-1607



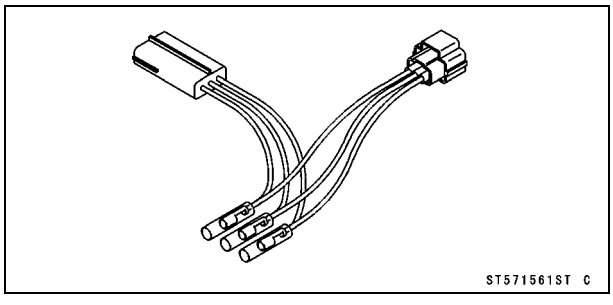
Throttle Sensor Setting Adapter:
57001-1521



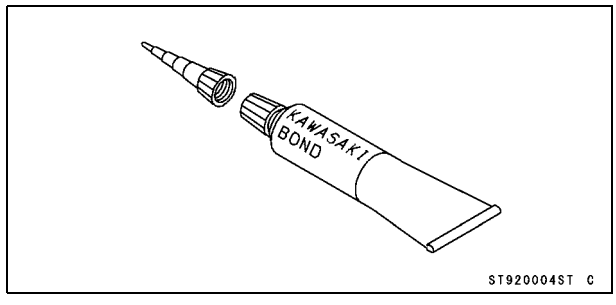
Kawasaki Bond (Silicone Sealant):
56019-120



Sensor Harness Adapter:
57001-1561

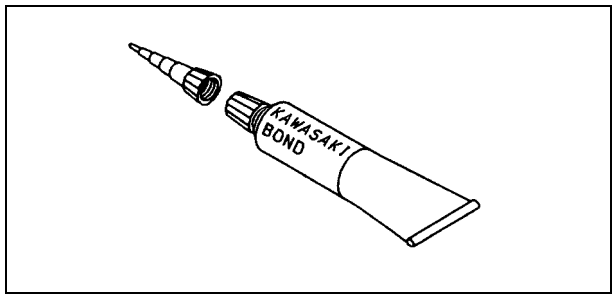


Kawasaki Bond (Silicone Sealant):
92104-0004

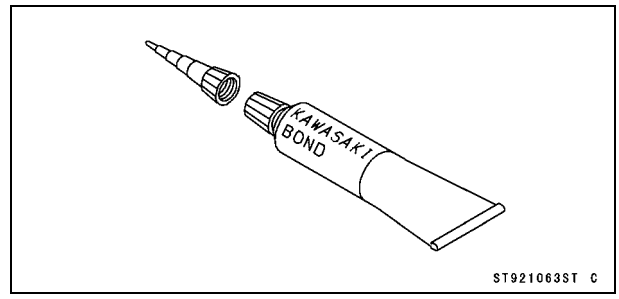


Special Tools and Sealant

Kawasaki Bond (Silicone Grease):
92137-1002

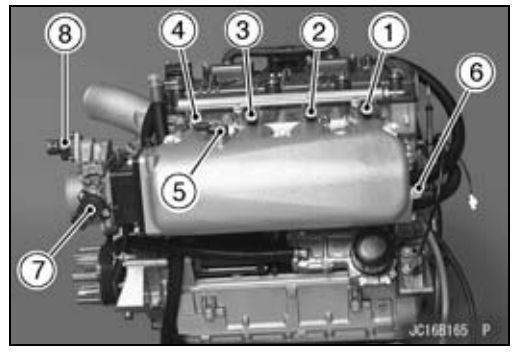


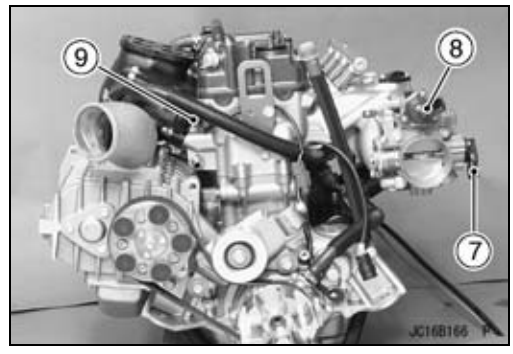
Kawasaki Bond (Liquid Gasket - Gray):
92104-1063

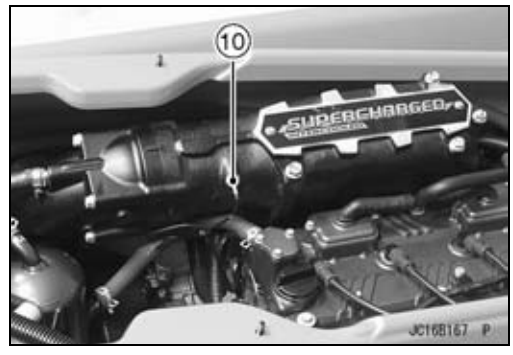


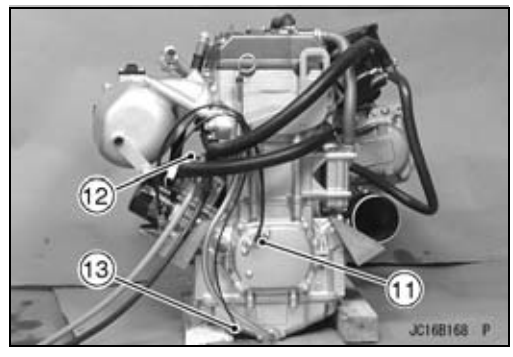
DFI Parts Location

1. Fuel Injector #1
2. Fuel Injector #2
3. Fuel Injector #3
4. Fuel Injector #4
5. Inlet Air Pressure Sensor
6. Inlet Air Temperature Sensor
7. Throttle Sensor
8. ISC (Idle Speed Controller)
9. Camshaft Position Sensor
10. Water Temperature Sensor
11. Crankshaft Sensor
12. Oil Pressure Switch
13. Oil Temperature Sensor



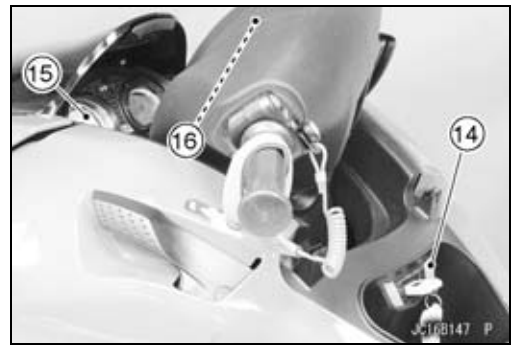


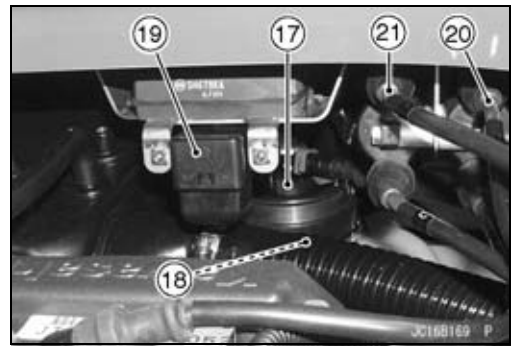


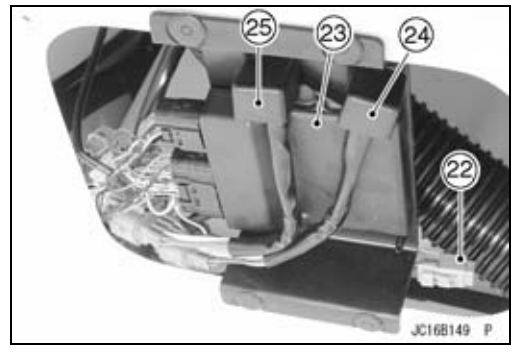


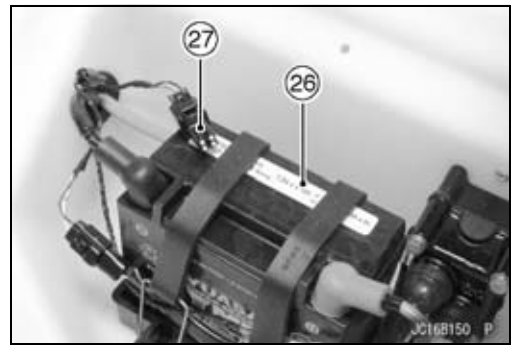
DFI Parts Location

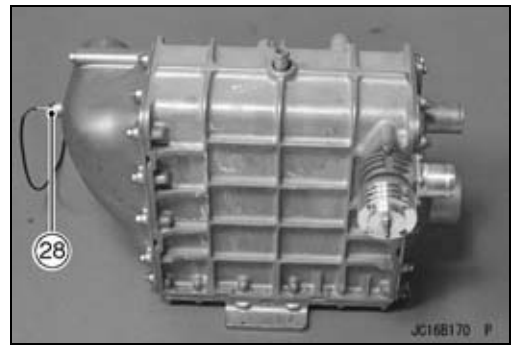
14. Ignition Switch
15. Meter Unit
16. Buzzer
17. Fuel Pump
18. Fuel Level Sensor
19. Vehicle-down Sensor
20. Ignition Coil #1, #4
21. Ignition Coil #2, #3
22. Main Fuse 20 A
23. ECU (Electronic Control Unit)
24. ECU Main Relay
25. Fuel Pump Relay
26. Battery
27. Diagnosis Connector
28. Charging Temperature Sensor





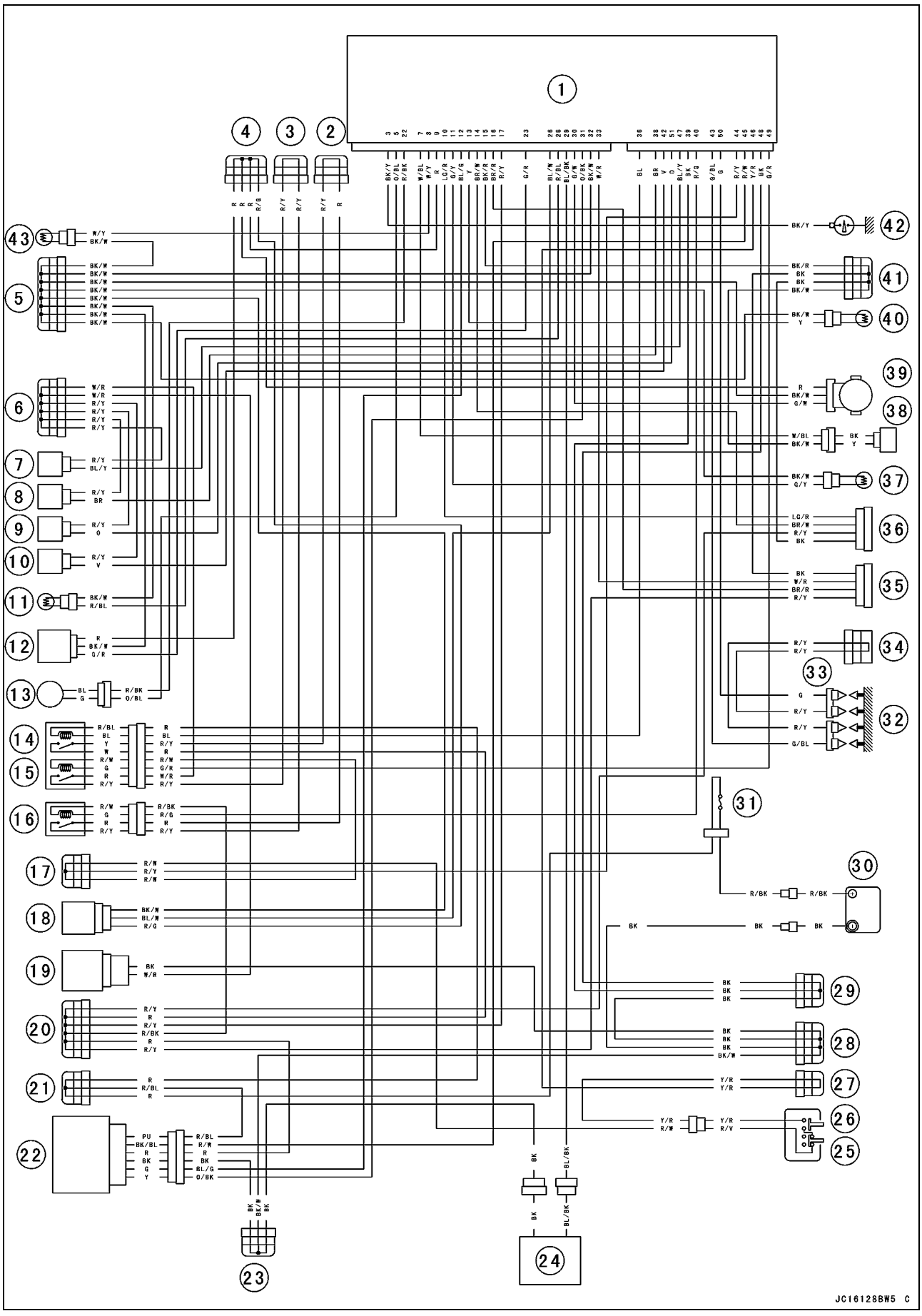






DFI System

DFI System Wiring Diagram

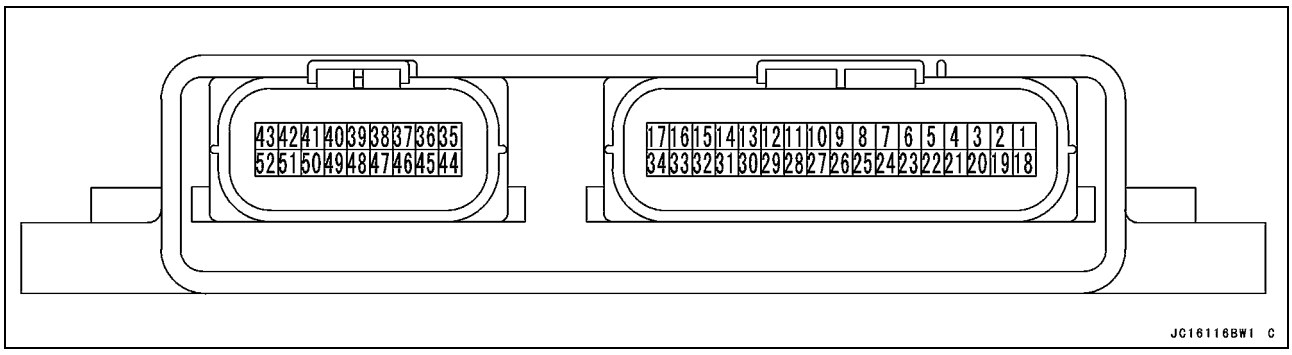


DFI System

1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. Joint Connector 6 (Power (5 V) - Sensor)
5. Joint Connector 5 (Ground - Sensor)
6. Joint Connector 4 (Power (12 V) - Injector)
7. Injector #4
8. Injector #3
9. Injector #2
10. Injector #1
11. Inlet Air Temperature Sensor
12. Inlet Air Pressure Sensor
13. Crankshaft Sensor
14. System Relay
15. Fuel Pump Relay
16. Main (ECU) Relay
17. Joint Connector 3 (Switch (12 V))
18. Vehicle-down Sensor
19. Fuel Pump
20. Joint Connector 2
21. Joint Connector 1
22. Ignition Switch (Immobilizer Amplifier)
23. Joint Connector 15 (Ground)
24. Multifunction Meter
25. Engine Stop Switch/Tether
26. Engine Start Switch
27. Joint Connector 13
28. Joint Connector 12 (Ground)
29. Joint Connector 11 (Ground)
30. Battery
31. Main Fuse 20 A
32. Spark Plugs
33. Ignition Coils
34. Joint Connector 10 (Ignition Coil (12 V))
35. Plug Nonuse
36. Plug Connector for DIAG and key Registration
37. Water Temperature Sensor
38. Camshaft Position Sensor (Exhaust)
39. Throttle Sensor
40. Oil Temperature Sensor
41. Joint Connector 9 (Ground Control)
42. Oil Pressure Switch
43. Charging Temperature Sensor

DFI System

Terminal Numbers of ECU Connectors



Terminal Names

1. ISC (Idle Speed Controller)
2. ISC (Idle Speed Controller)
3. Oil Pressure Switch
4. Unused
5. Crankshaft Sensor (–)
6. Unused (to unused connector)
7. Camshaft Position Sensor
8. Charging Temperature Sensor
9. Power Supply to Sensors
10. External Communication Line (Immobilizer System)
11. Water Temperature Sensor
12. Immobilizer Amplifier
13. Oil Temperature Sensor
14. External Communication Line (*KDS)
15. Ground for Control System
16. External Communication Line (to unused connector)
17. Battery (+)
18. ISC (Idle Speed Controller)
19. ISC (Idle Speed Controller)
20. Engine Stop Switch
21. Steering Position Sensor
22. Crankshaft Sensor (+)
23. Inlet Air Pressure Sensor
24. Unused
25. Unused
26. Vehicle-down Sensor
27. Unused
28. Inlet Air Temperature Sensor
29. Meter (DIAG)
30. Throttle Sensor
31. Immobilizer Amplifier
32. Ground for Sensor
33. External Communication Line (to unused connector)
34. Battery Monitor
35. Unused
36. System Relay (–)
37. Unused
38. Injector #3
39. Ground for Power
40. Main (ECU) Relay
41. Unused
42. Injector #1
43. Ignition Coil #1, #4
44. Main Switch (To Meter)
45. Entry Switch (to Immobilizer Amplifier)
46. Start Switch
47. Injector #4
48. Ground for Power
49. Fuel Pump Relay
50. Ignition Coil #2, #3
51. Injector #2
52. unused

*KDS (Kawasaki Diagnostic System)

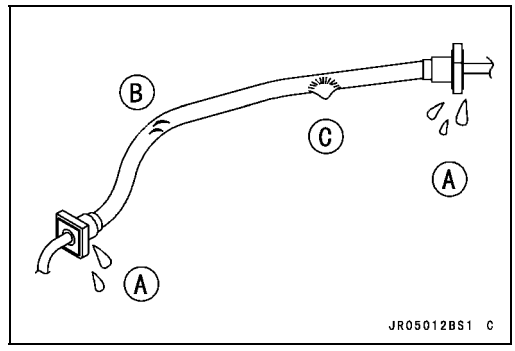
KDS that runs on Windows personal computer (PC) diagnostic tool for watercraft with Kawasaki DFI system.

DFI Servicing Precautions

There are a number of important precautions that should be followed servicing the DFI system.

- This DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- Do not reverse the battery cable connections. This will damage the ECU.
- To prevent damage to the DFI parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to the engine ground.
- When charging, remove the battery from the vehicle. This is to prevent ECU damage by excessive voltage.
- Whenever the DFI electrical connections are to be disconnected, first turn off the ignition switch. Conversely, make sure that all the DFI electrical connections are firmly reconnected before starting the engine.
- Do not turn the ignition switch ON while any of the DFI electrical connectors are disconnected. The ECU memorizes service codes.
- If a transceiver is installed on the vehicle, make sure that the operation of the DFI system is not influenced by electric wave radiated from the antenna. Check operation of the system with the engine at idle. Locate the antenna as far as possible away from the ECU.
- When any fuel hose is disconnected, do not turn on the ignition switch. Otherwise, the fuel pump will operate and fuel will spout from the fuel hose.
- Do not operate the fuel pump if the pump is completely dry. This is to prevent pump seizure.
- Before removing the fuel system parts, blow the outer surfaces of these parts clean with compressed air.
- When any fuel hose is disconnected, fuel may spout out by residual pressure in the fuel line. Cover the hose joint with a piece of clean cloth to prevent fuel spillage.
- When installing the fuel hoses, avoid sharp bending, kinking, flattening or twisting, and route the fuel hoses with a minimum of bending so that the fuel flow will not be obstructed.
- Route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.

- The high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Bend and twist the fuel hose while examining it.
- Replace the hose if any cracks [B] or bulges [C] are noticed.



DFI Servicing Precautions

○When checking the DFI parts, do not run the engine for 15 seconds or more without auxiliary cooling (see General Information chapter).

CAUTION

If running the engine without the auxiliary cooling for 15 seconds or more (even at idle speed), the rubber component relative to the Exhaust System may be damaged.

○Execute the auxiliary cooling securely in case that frequent engine running is required.

● When checking the DFI parts, use a digital meter which can be read two decimal place voltage or resistance.

○The DFI part connectors have seals, including the ECU. When measuring the input or output voltage with the connector joined, use the needle adapter set. Insert the needle adapter inside the seal until the needle adapter reaches the terminal.

Digital Meter [A]

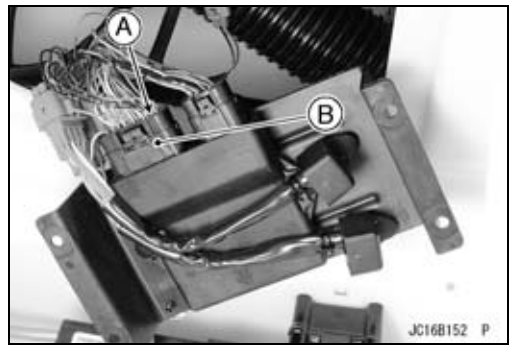
Special Tool - Needle Adapter Set: 57001-1457

CAUTION

Insert the needle adapter straight along the terminal in the connector to prevent short-circuit between terminals.

○After measurement, remove the needle adapters and apply silicone sealant to the seals [A] of the connector [B] for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) - Seals of Connector



● Always check battery condition before replacing the DFI parts. A fully charged battery is a must for conducting accurate tests of the DFI system.

● Do not directly connect a 12 V battery to a fuel injector. Insert a resistor (5 ~ 7 Ω) or a bulb (12 V, 3 ~ 3.4 W) in series between the battery and the injector.

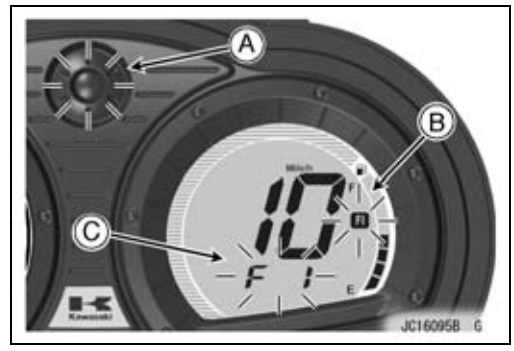
Self-Diagnosis

Self-diagnosis Outline

The self-diagnosis system has two modes and can be switched to another mode.

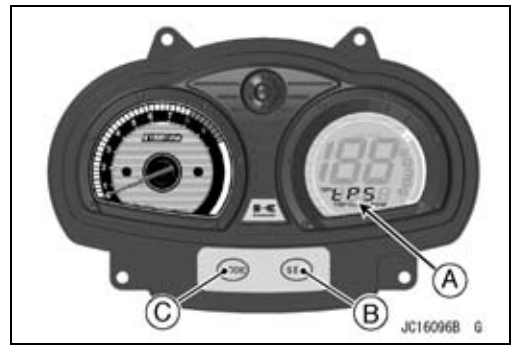
[A] Push the “SET” button with “MODE” button at the same time for 3 seconds or more.

[B] Push either “SET” or “MODE” button for more than one second or more.



User Mode

This is a standard mode and enters automatically after ignition switch ON. The ECU notifies the rider of troubles in DFI system and ignition system by going on LED warning light [A] by flashing, the FI indicator [B] and “FI” character [C] when DFI system and ignition system parts are faulty, and initiates fail-safe function. The buzzer sound goes on. In case of serious troubles ECU stops the injection/ignition/starter motor operation. The buzzer sound can be stopped by pushing either “SET” or “MODE” button.



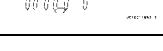
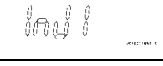
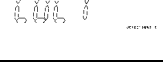
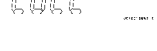
Dealer Mode

The LCD in the meter unit displays service code character [A] to show the problem(s) which the DFI system and ignition system has at the moment of diagnosis.

- To enter the dealer mode push the “SET” button [B] with “MODE” button [C] for 3 seconds or more.
- Read the service code character in the LCD display. Refer to the “Service Code (Character) Table” in the following section.
- To return the user mode push either “SET” or “MODE” button for one second or more.
- The service code character(s) will not be shown on the LCD in the meter unit after the problems are solved.

Self-Diagnosis

Service Code (Character) Table

Service Code (used in ECU)	Service Code Character (displayed on Meter Unit)	Possible Problems	Fail-Safe Function
11		Throttle sensor malfunction, wiring open or short	The ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the D-J method (see Note 1).
12		Inlet air pressure sensor malfunction, wiring open or short	The ECU sets the DFI in the α-N method (see Note 2).
13		Inlet air temperature sensor malfunction, wiring open or short	The ECU sets the inlet air temperature at 40°C.
14		Water temperature sensor malfunction, wiring open or short	The ECU sets the water temperature at 70°C. The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition (Engine activates Slow Down Mode).
19		Charging temperature sensor malfunction, wiring open or short	The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition.
21		Crankshaft sensor malfunction, wiring open or short	–
23		Camshaft position sensor malfunction, wiring open or short	The ECU continues to ignite cylinders in the same sequence following the last good signal.
31		Vehicle-down sensor malfunction, wiring open or short	The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition.
35		Immobilizer amplifier malfunction	–
36		Key collation error	–
45		Fuel pump relay malfunction, wiring open	–
46		Fuel pump relay malfunction, relay is stuck	–
51		Ignition coil #1, #4 malfunction, wiring open or short	The ECU shuts off the injectors #1/#4 to stop fuel to the cylinders #1/#4.
52		Ignition coil #2, #3 malfunction, wiring open or short	The ECU shuts off the injectors #2/#3 to stop fuel to the cylinders #2/#3.
71		Engine overheat	The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition.
72		Engine oil pressure too low	The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition.

Self-Diagnosis

Service Code (used in ECU)	Service Code Character (displayed on Meter Unit)	Possible Problems	Fail-Safe Function
73		Oil temperature sensor malfunction, wiring open or short	The ECU sets the oil temperature at 60°C. The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition.
75		Main (ECU) relay and system relay malfunction, wiring is open or relay is stuck	–
76		Engine oil overheat	The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition.
78		Charging temperature too high	The ECU set the charging temperature at 60°C. The ECU slows down the engine speed less than 3 000 r/min (rpm) by controlling the ignition (Engine activates Slow Down Mode).

Note:

(1) D-J Method: the DFI control method from medium to heavy engine load. When the engine load is light like at idling or low speed, the ECU determines the injection quantity by calculating from the throttle vacuum (vacuum sensor output voltage) and engine speed (crankshaft sensor output voltage).

(2) α-N Method: As the engine speed increases, and the engine load turns middle to heavy, the ECU determines the injection quantity by calculating from the throttle opening (throttle sensor output voltage) and the engine speed.

(3) If both throttle sensor system and inlet air pressure fails, the ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the α-N method.

(4) The ECU may be involved in these problems. If all the parts and circuits are checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked good, replace the ECU.

Memory of Service Code (Character)

The service codes (characters) in the past are stored in the ECU. However, the characters cannot be displayed in the meter. The past service codes can be confirmed by using the Kawasaki Diagnostic System (see General Information chapter), and they can be erased.

Troubleshooting the DFI System

Sample Diagnosis Sheet

Rider name:	**Registration No. (license plate No.):**	**Year of initial registration:**
Model:	**Engine No.:**	**Hull No.:**
Date problem occurred:		**Mileage:**
Environment when problem occurred.		
Weather	☐ fine, ☐ cloudy, ☐ rain, ☐ snow, ☐ always, ☐ other:	
Temperature	☐ hot, ☐ warm, ☐ cold, ☐ very cold, ☐ always	
Problem frequency	☐ chronic, ☐ often, ☐ once	
Altitude	☐ normal, ☐ high (about 1 000 m or more)	
Watercraft conditions when problem occurred.		
Warning LED light, FI character, FI indicator	☐ turn on immediately after ignition switch ON, and turn off after 1 ~ 2 seconds (normal).	
	☐ lights blink after ignition switch ON, and stay on (DFI problem)	
	☐ unlights (LED light, meter unit, ECU or its wiring fault).	
	☐ sometimes lights up (probably wiring fault).	
Starting difficulty	☐ starter motor not rotating.	
	☐ starter motor rotating but engine doesn't turn over.	
	☐ starter motor and engine don't turn over.	
	☐ no fuel flow (☐ no fuel in tank, □ no fuel pump sound).	
	☐ engine flooded (do not crank engine with throttle opened, which promotes engine flooding).	
	☐ no spark.	
	☐ other:	
Engine stalls	☐ right after starting.	
	☐ when opening throttle lever.	
	☐ when closing throttle lever.	
	☐ when moving off.	
	☐ when stopping the watercraft.	
	☐ when cruising.	
	☐ other:	
Poor running at low speed	☐ very low idle speed, ☐ very high idle speed, ☐ rough idle speed.	
	☐ battery voltage is low (charge the battery).	
	☐ spark plug loose (tighten it).	
	☐ spark plug dirty, broken, or gap maladjusted (remedy it).	
	☐ backfiring.	
	☐ afterfiring.	
	☐ hesitation when acceleration.	
	☐ engine oil viscosity too high.	
	☐ engine overheating.	
	☐ other:	

Troubleshooting the DFI System

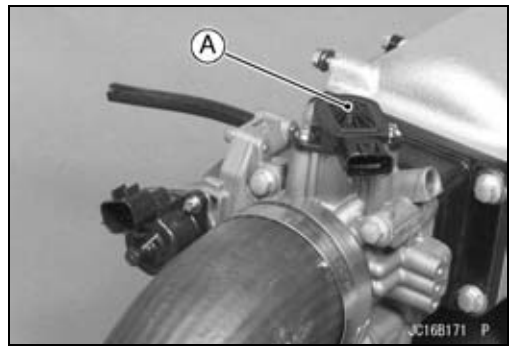
Poor running or no power at high speed	☐ spark plug loose (tighten it).
	☐ spark plug dirty, broken, or gap maladjusted (remedy it).
	☐ spark plug incorrect (replace it).
	☐ knocking (fuel poor quality or incorrect).
	☐ engine overheating.
	☐ engine oil level too high.
	☐ engine oil viscosity too high.
	☐ other:

Throttle Sensor (Service Code/Character-11/tPS)

Throttle Sensor Removal/Adjustment

CAUTION

Never drop the throttle sensor [A], especially on a hard surface. Such a shock to the sensor can damage it.

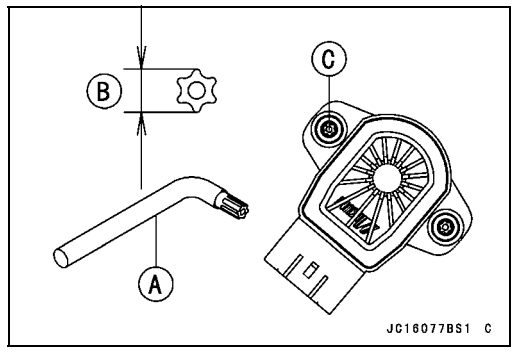


● Remove:
Seat (see Seat Removal in the Hull/Engine Hood chapter)
Air filter (see air Filter Removal)

● Use a Torx wrench [A] (T20, B = 3.86 mm (0.152 in.)) to remove the throttle sensor mounting screws [C].

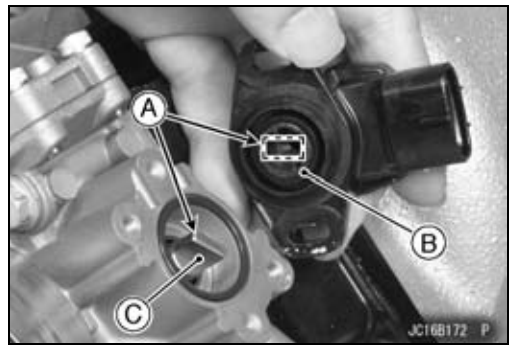
NOTE

○*In the engine compartment, there is not enough space between the throttle sensor and hull to remove the Torx screws. So use an L shape Torx wrench.*

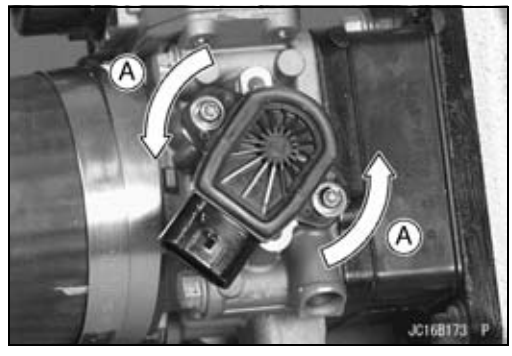


● When installing the throttle sensor, note the following (In the photo, the throttle sensor has been removed from the throttle body for clarity).

○Align [A] the projections [B] on the throttle sensor with the throttle shaft [C] as shown when putting the throttle sensor to the throttle body.

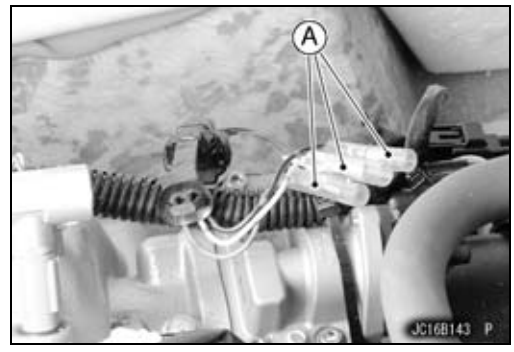


○Turn the throttle sensor counterclockwise [A] a little and temporarily tighten the throttle sensor mounting screws.



Throttle Sensor (Service Code/Character-11/tPS)

● Adjust the throttle sensor positioning as follows.
○Install the air filter temporarily.
○After warming up the engine, check the idling speed.

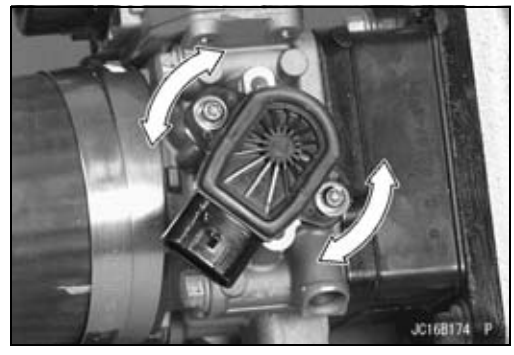


Idle Speed
Standard: 1 300 ±100 r/min (rpm)

○Stop the engine and turn the ignition switch OFF.
○Disconnect the throttle sensor connector and connect the throttle sensor setting adapter [A] between the harness connector and throttle sensor connector.
○Connect a digital meter to the sensor setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001 -1521

Throttle Sensor Output Voltage
Connections to Sensor
Meter (+)→ G/W lead
Meter (–)→ BK/W lead



○Start the engine with idle speed.
○Turn [A] the throttle sensor and bring the sensor output voltage within the standard range.

Output Voltage at Sensor
Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)

○Tighten the throttle sensor mounting screws.

Torque - Throttle Sensor Mounting Screws: 2.0 N·m (0.20 kgf·m, 18 in·lb)

○Recheck the sensor output voltage is within the standard range.
○Stop the engine and turn the ignition switch OFF.
○Remove the setting adapter and reconnect the throttle sensor connector.

Input Voltage Inspection

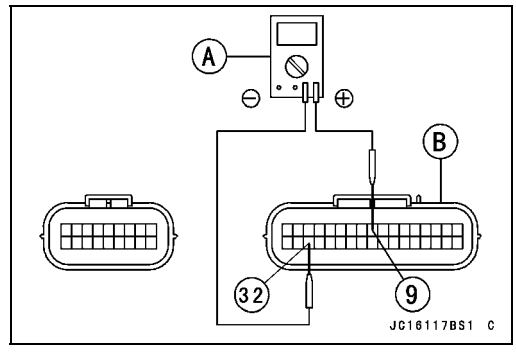
NOTE

○*Be sure the battery is fully charged.*

● Turn the ignition switch OFF.
● Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.

● Connect a digital voltmeter [A] to the connector [B], using the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457



Throttle Sensor Input Voltage
Connections to ECU
Meter (+)→ R lead (terminal 9)
Meter (–)→ BK/W lead (terminal 32)

Throttle Sensor (Service Code/Character-11/tPS)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.

○Wait 15 seconds before using the starter again.

Input Voltage at ECU
Standard: 4.75 ~ 5.25 V DC

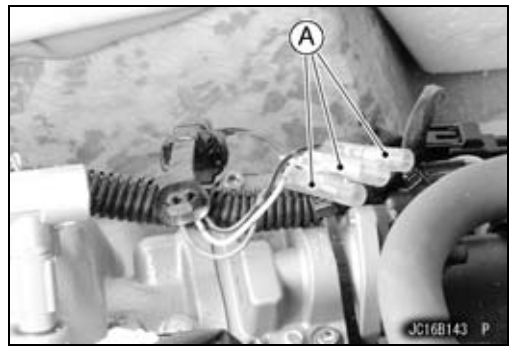
- Turn the ignition switch OFF.

★If the reading of input voltage is less than the standard, check the ECU for its ground, power supply and wiring shorted. If the ground, power supply and wiring are good, replace the ECU.

★If the input voltage is within the standard range, check the input voltage at the throttle sensor connector.

- Remove the air filter temporarily (see Air Filter Removal).
- Disconnect the throttle sensor connector and connect the setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001 -1521



Throttle Sensor Input Voltage
Connections to Sensor
Meter (+)→ R lead
Meter (–)→ BK/W lead

- Install the air filter.
- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.

○Wait 15 seconds before using the starter again.

Input Voltage at Sensor
Standard: 4.75 ~ 5.25 V DC

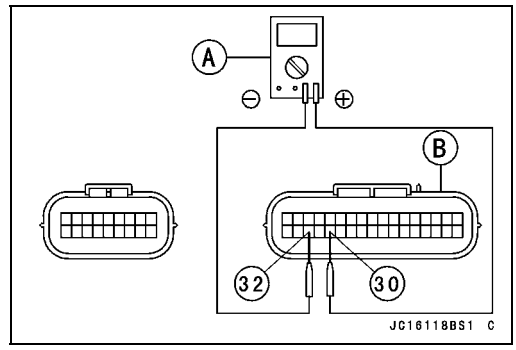
- Turn the ignition switch OFF.

★If the reading is out of the range, check the wiring (see wiring diagram in this section).

★If the reading is good, check the output voltage of the sensor.

Throttle Sensor (Service Code/Character-11/tPS)

Output Voltage Inspection



- Measure the output voltage at the ECU in the same way as input voltage inspection. Note the following.
  Digital Voltmeter [A]
  Connector [B]

  Special Tool - Needle Adapter Set: 57001-1457

  Throttle Sensor Output Voltage
  Connections to ECU
  Meter (+) → G/W lead (terminal 30)
  Meter (–) → BK/W lead (terminal 32)

- Start the engine.
- Check idle speed to ensure throttle opening is correct.

  Idle Speed
  Standard: 1 300 ±100 r/min (rpm)

- Measure the sensor output voltage with the idle speed.

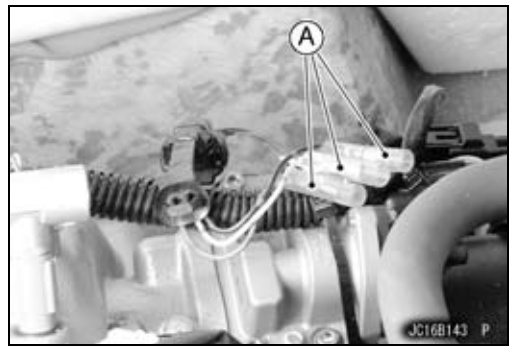
  Output Voltage at ECU
  Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)

CAUTION
Never drop the throttle sensor especially on a hard surface. A shock to the sensor can damage it.

★If the output voltage is within the standard range, check the ECU for a good ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.

★If the output voltage is far out of the standard range (e.g. when the wiring is open, the reading is 0 V), check the output voltage at the sensor connector.

Throttle Sensor (Service Code/Character-11/tPS)



- Disconnect the throttle sensor connector and connect the setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001 -1521

Throttle Sensor Output Voltage
Connections to Sensor
Meter (+) → G/W lead
Meter (–) → BK/W lead

- Measure the sensor output voltage with the idle speed.

Output Voltage at Sensor
Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)

CAUTION

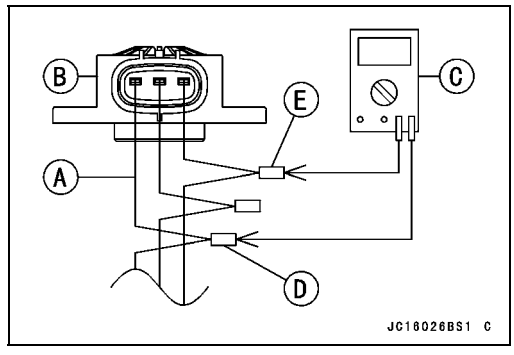
Never drop the throttle sensor, especially on a hard surface. A shock to the sensor can damage it.

- After throttle sensor voltage inspection, remove the setting adapter.

★If the reading is out of the standard range, inspect the throttle sensor resistance.

★If the output voltage is normal, check the wiring for continuity (see next diagram).

Resistance Inspection



- Turn the ignition switch OFF.
- Remove:
  Air Filter (see Air Filter Removal)
- Disconnect the throttle sensor connector and connect the setting adapter [A] to the throttle sensor [B].

Special Tool - Throttle Sensor Setting Adapter: 57001 -1521

○Do not connect the harness connector.

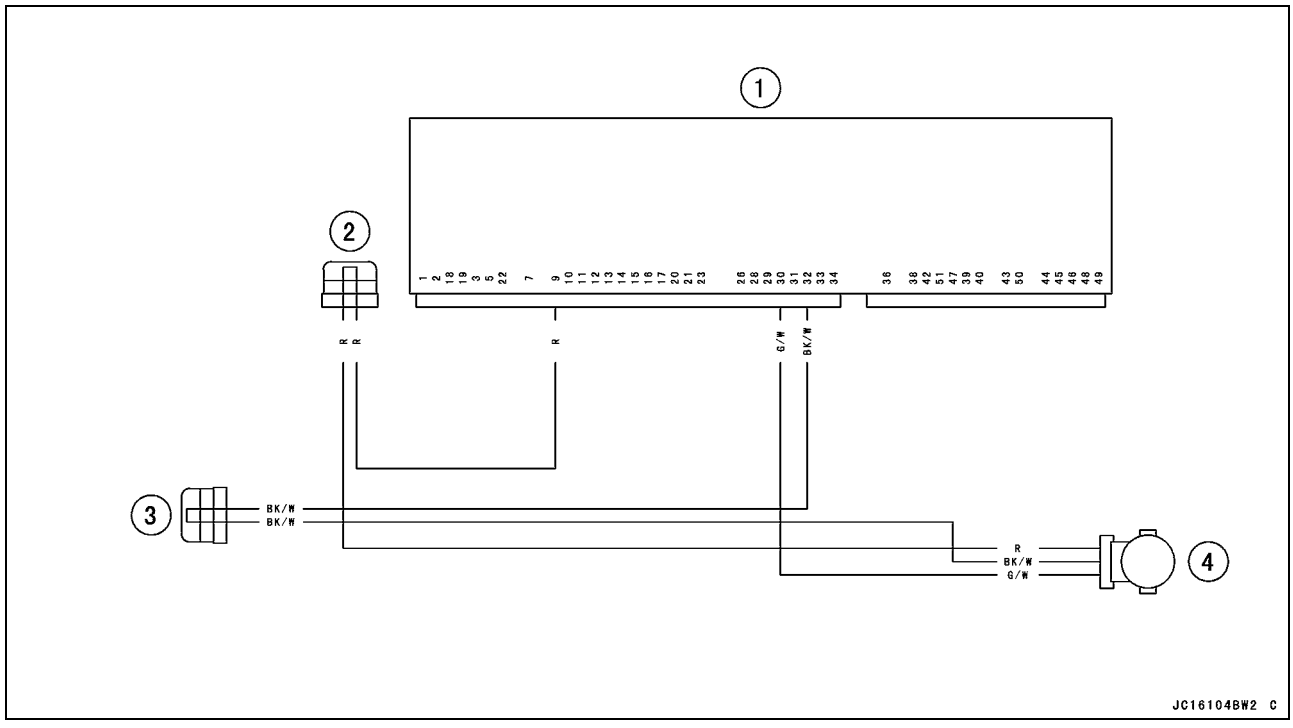
- Connect a digital meter [C] to the harness adapter leads.
- Measure the throttle sensor resistance.

Throttle Sensor Resistance
Connections to
Harness Adapter: R lead [D] ←→ BK/BL lead [E]
Standard: 4 ~ 6 kΩ

★If the reading is out of the range, replace the throttle body assy.

★If the reading is within the range, but the problem still exists, replace the ECU.

Throttle Sensor (Service Code/Character-11/tPS)



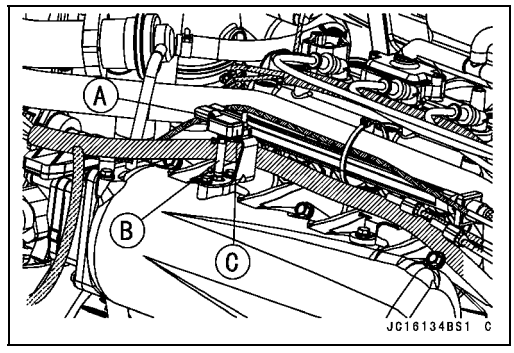
1. ECU
2. Joint Connector 6 (Power (5 V) - Sensor)
3. Joint Connector 5 (Ground - Sensor)
4. Throttle Sensor

Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the part can damage it.

Inlet Air Pressure Sensor Removal



- Turn the ignition switch off.
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Inlet Air Pressure Sensor Connector [A]
  Hose [B] (Disconnect)
  Inlet Air Pressure Sensor [C]

Inlet Air Pressure Sensor Installation

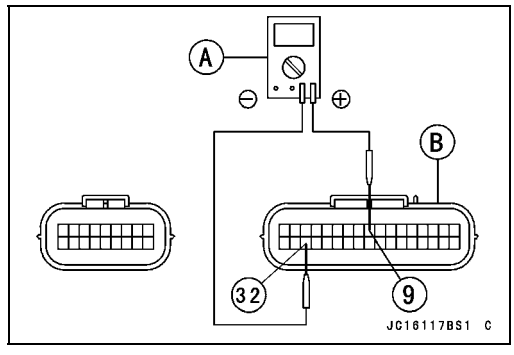
- Install the vacuum hose.
- Put the inlet air pressure sensor in the stay plate of the inlet manifold.

Input Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*
○*The inspection is the same as "Input Voltage Inspection" of the throttle sensor.*

- Turn the ignition switch OFF.
- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.



- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Pressure Sensor Input Voltage
Connections to ECU
Meter (+)→ R lead (terminal 9)
Meter (–) → BK/W lead (terminal 32)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.

○Wait 15 seconds before using the starter again.

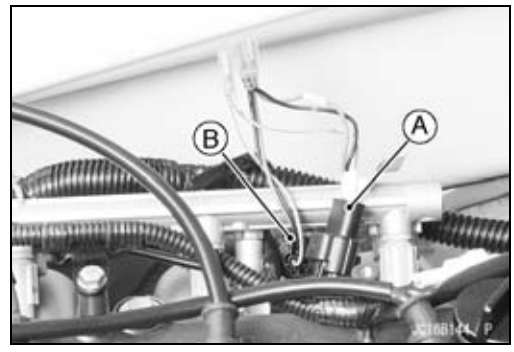
Input Voltage at ECU
Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.

★If the reading is less than the standard, check the ECU for its ground, power supply and wiring. If the ground, power supply and wiring are good, replace the ECU.

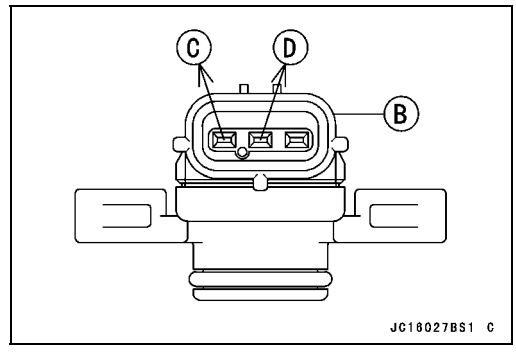
Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

★If the reading is within the standard range, and check the input voltage at the sensor connector.
- Disconnect the inlet air pressure sensor connector and connect the harness adapter [A] between the harness connector and inlet air pressure sensor connector.
- Connect a digital meter to the harness adapter leads.
  [B] Inlet Air Pressure Sensor



Special Tool - Sensor Harness Adapter: 57001-1561

Inlet Air Pressure Sensor Input Voltage
Connections to Sensor
Meter (+) → R lead [C]
Meter (–) → BK/W lead [D]



- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.

○Wait 15 seconds before using the starter again.

Input Voltage at Sensor Connector
Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.

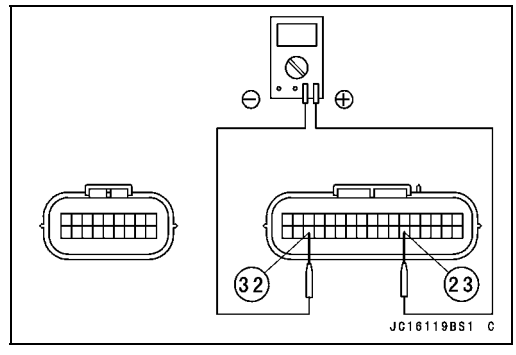
★If the reading is out of the standard range, check the wiring (see Wiring Diagram in this section).

★If the reading is good, the input voltage is normal. Check the output voltage.

Output Voltage Inspection

- Measure the output voltage at the ECU in the same way as input voltage inspection. Note the following.

Inlet Air Pressure Sensor Output Voltage
Connections to ECU
Meter (+) → G/R lead (terminal 23)
Meter (–) → BK/W lead (terminal 32)



Output Voltage at ECU
Usable Range: 3.75 ~ 4.25 V DC at the standard atmospheric pressure (101.32 kPa, 76 cmHg absolute)

NOTE

○*The output voltage changes according to the local atmospheric pressure.*

○*The vacuum sensor output voltage is based on a nearly perfect vacuum in the small chamber of the sensor. So, the sensor indicates absolute vacuum pressure.*

★If the output voltage is within the usable range, check the ECU for its ground, power supply and wiring. If the ground, power supply and wiring are good, replace the ECU.

Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

★If the output voltage is far out of the usable range, check the output voltage at the sensor connector [A].

● Measure the output voltage at the sensor in the same way as input voltage inspection. Note the following.
[B] Inlet Air Pressure Sensor

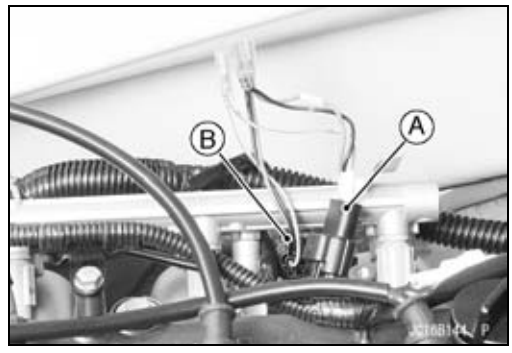
Special Tool - Sensor Harness Adapter: 57001-1561

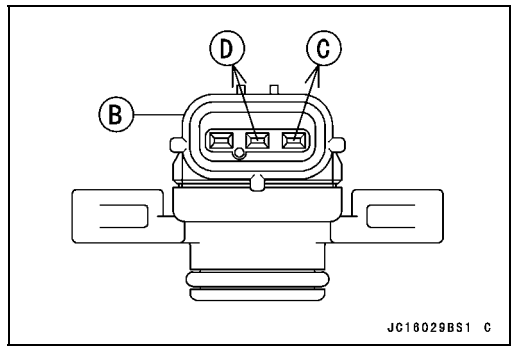
Inlet Air Pressure Sensor Output Voltage
Connections to Sensor

Meter (+) → G/R lead [C]

Meter (–) → BK/W lead [D]

Output Voltage at Sensor Connector
Usable Range: 3.75 ~ 4.25 V DC at the standard atmospheric pressure (101.32 kPa or 76 cmHg absolute)





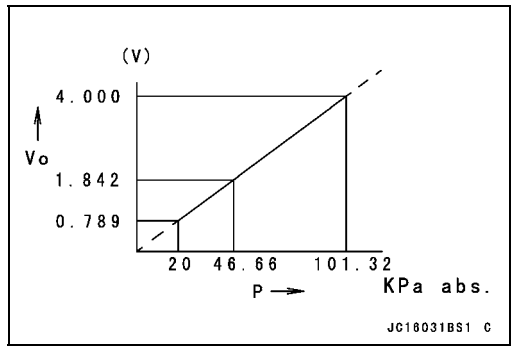
★If the output voltage is normal, check the wiring for continuity (see next diagram).

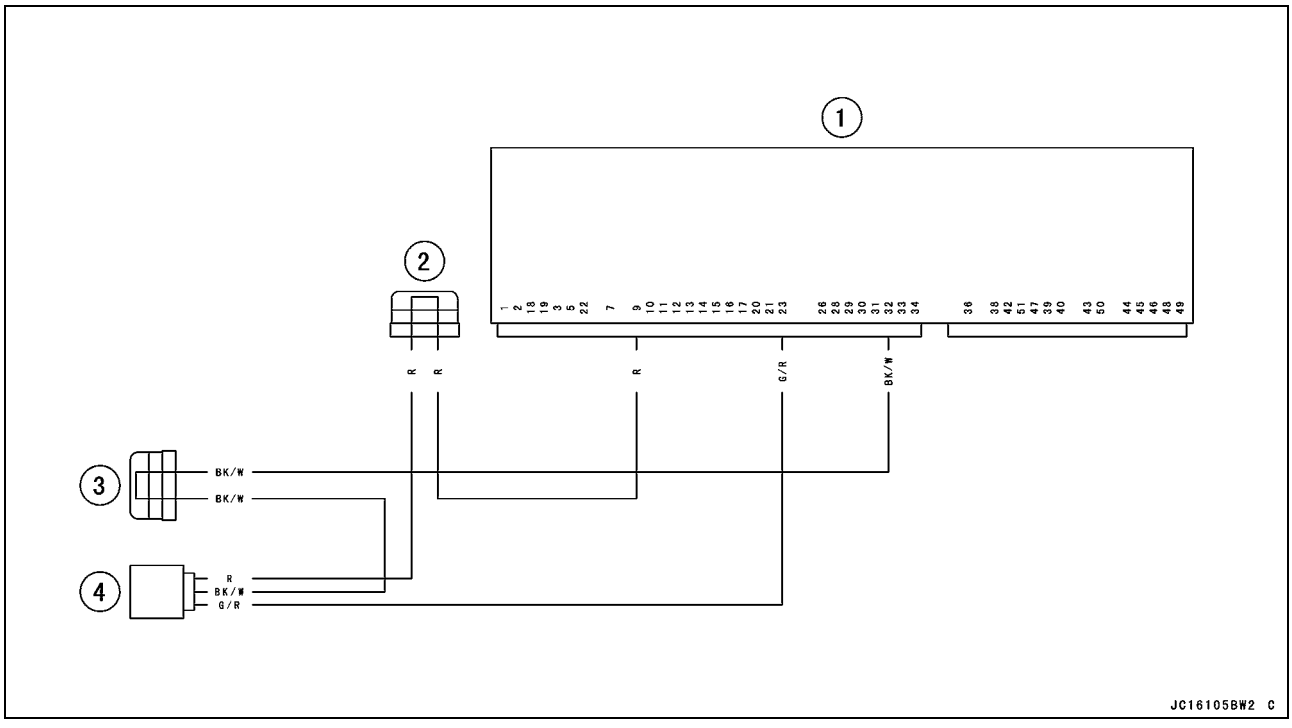
★If the output voltage is out of the usable range, replace the sensor.

● Turn the ignition switch OFF.

● Remove the sensor harness adapter.

Output Voltage Performance
(at Input Voltage: 4.75 ~ 5.25 V)
P: Vacuum Pressure
Vo: Output Voltage

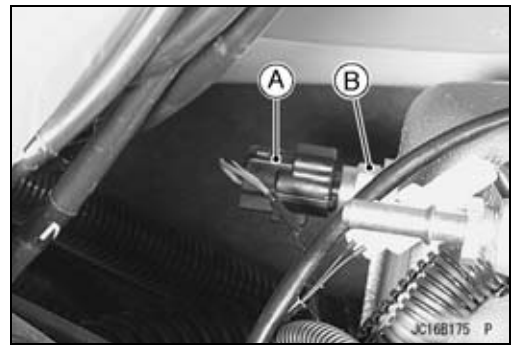




1. ECU
2. Joint Connector 6 (Power (5 V) - Sensor)
3. Joint Connector 5 (Ground - Sensor)
4. Inlet Air Pressure Sensor

Inlet Air Temperature Sensor (Service Code/Character-13/Alrt)

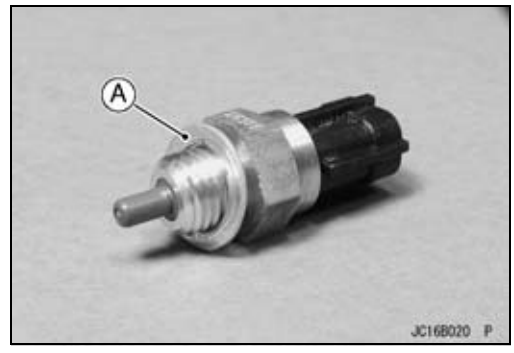
Inlet Air Temperature Removal/Installation



CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Disconnect the following to make service easy.
  Spark Plug Caps
  Fuel Hose
  Air Bypass Hose (Upper Side)
- Disconnect the connector [A] from the inlet air temperature sensor.
- Remove the inlet air temperature sensor [B] and washer.



- Install the inlet air temperature sensor and washer [A].
- Tighten:

Torque - Inlet Air Temperature Sensor: 20 N·m (2.0 kgf·m, 14 ft·lb)

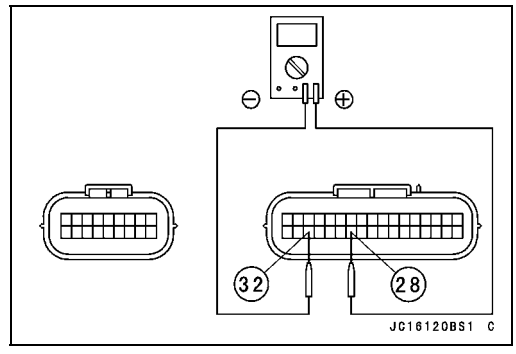
Output Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.
- Connect a digital voltmeter to the ECU connector, using needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457



Inlet Air Temperature Sensor Output Voltage
Connections to ECU Connector

Meter (+) → R/BL lead (terminal 28)

Meter (–) → BK/W lead (terminal 32)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.

○Wait 15 seconds before using the starter again.

Output Voltage at ECU
Standard: about 2.3 ~ 2.6 V at inlet air temperature 20°C (68°F)

NOTE

○*The output voltage changes according to the inlet air temperature.*

- Turn the ignition switch OFF.

Inlet Air Temperature Sensor (Service Code/Character-13/Alrt)

★If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.

★If the output voltage is far out of the specified, check the wiring (see next diagram).

● Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors

★If the wiring is good, check the sensor resistance.

Sensor Resistance Inspection

● Remove the inlet air temperature sensor (see Inlet Air Temperature Sensor Removal).

● Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.

● Suspend a thermometer [B] with the heat-sensitive portion [C] located in almost the same depth with the sensor.

NOTE

○*The sensor and thermometer must not touch the container side or bottom.*

● Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.

● Using a digital meter, measure the internal resistance of the sensor across the terminals at the temperatures shown in the table.

Inlet Air Temperature Sensor Resistance

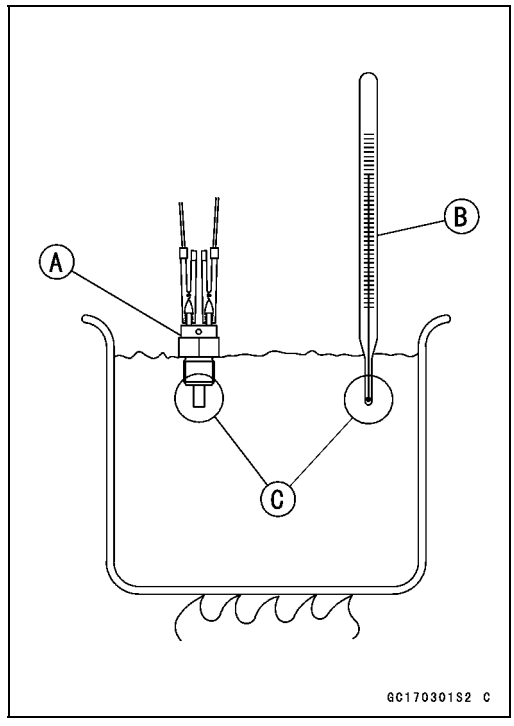
Standard: 5.4 ~ 6.6 kΩ at 0°C (32°F)

2.26 ~ 2.86 kΩ at 20°C (68°F)

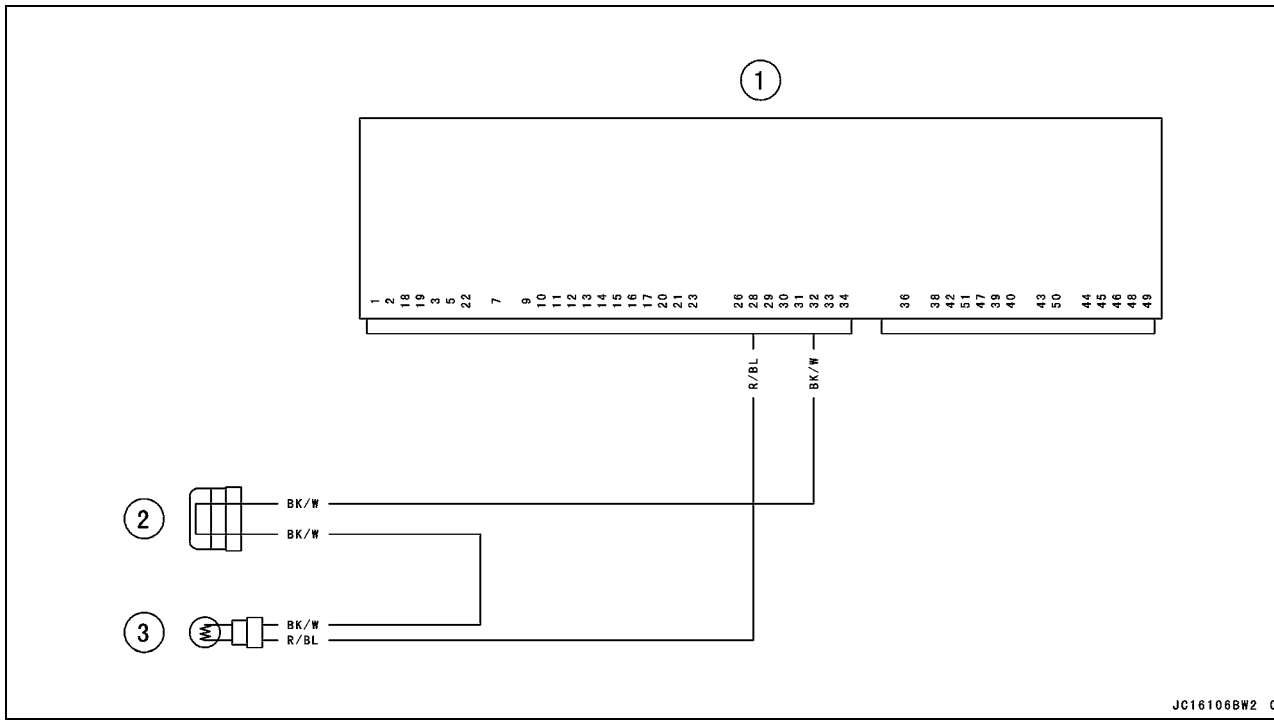
0.29 ~ 0.39 kΩ at 80°C (176°F)

★If the measurement is out of the range, replace the sensor.

★If the measurement is within the specified, replace the ECU.



Inlet Air Temperature Sensor (Service Code/Character-13/Alrt)



1. ECU
2. Joint Connector 5 (Ground - Sensor)
3. Inlet Air Temperature Sensor

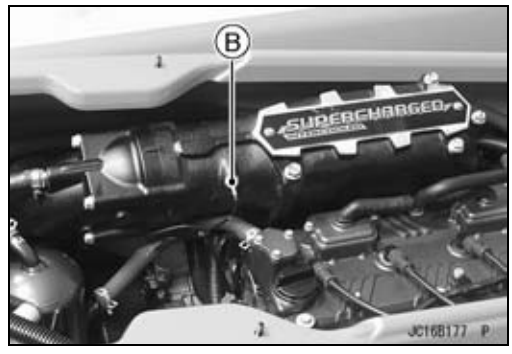
Water Temperature Sensor (Service Code/Character-14/AqUt)

Water Temperature Sensor Removal/Installation

CAUTION

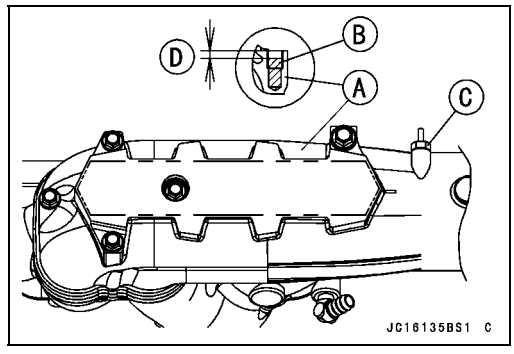
Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Disconnect the sensor connector [A], and unscrew the water temperature sensor [B].



- When installing the water temperature sensor, remove the exhaust pipe for the engine oil filling in the hollow of the exhaust manifold.
- Fill the hollow of the exhaust pipe [A] with the engine oil (10W-30) [B] as shown, before installing the water temperature sensor [C].
  [D] 5 mm (0.2 in.)
- Tighten:

Torque - Water Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)



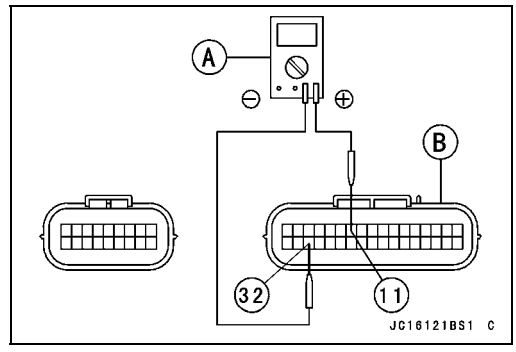
Output Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Remove the ECU (see ECU Removal). Do not disconnect the connector.

Water Temperature Sensor (Service Code/Character-14/AqUt)



- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage
Connections to ECU

Meter (+) → G/Y lead (terminal 11)

Meter (–) → BK/W lead (terminal 32)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.

○Wait 15 seconds before using the starter again.

Output Voltage at ECU
Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

○*The output voltage changes according to the coolant temperature in the engine.*

- Turn the ignition switch OFF.

★If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.

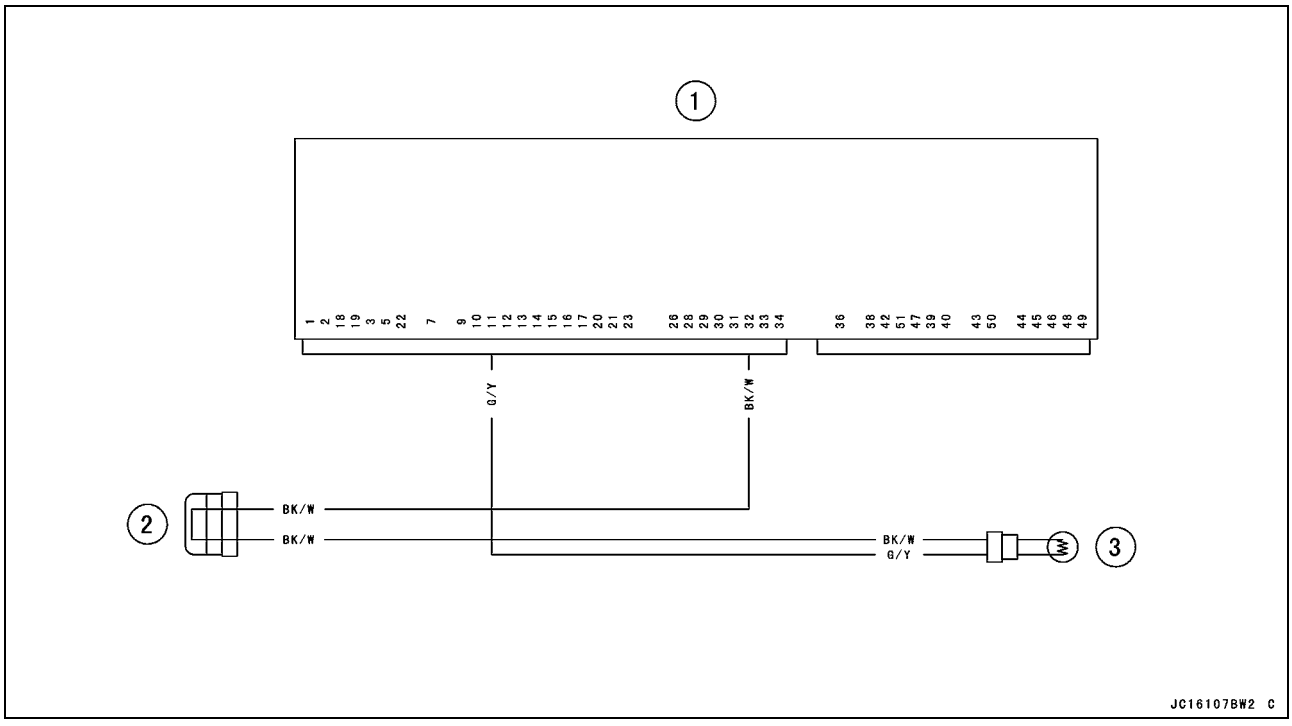
★If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).

★If the wiring is good, check the water temperature sensor resistance.

- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors

Water Temperature Sensor (Service Code/Character-14/AqUt)



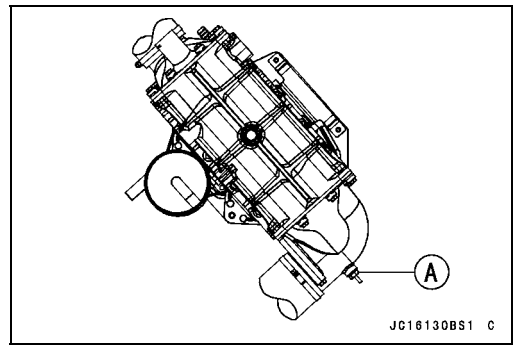
1. ECU
2. Joint Connector 5 (Ground - Sensor)
3. Water Temperature Sensor

Sensor Resistance Inspection

- Remove the water temperature sensor (see Water Temperature Sensor Removal/Installation).
- Refer to Electrical System chapter for water temperature sensor inspection.

Charging Temperature Sensor (Service Code/Character-19/PrET)

Charging Temperature Sensor Removal/Installation



CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Charging Temperature Sensor [A]
- Tighten:

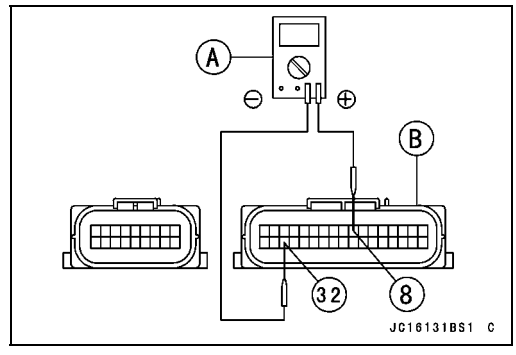
Torque - Charging Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)

Output Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Remove the ECU (see ECU Removal). Do not disconnect the connector.



- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage
Connections to ECU
Meter (+) → W/Y lead (terminal 8)
Meter (–) → BK/W lead (terminal 32)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.

○Wait 15 seconds before using the starter again.

Output Voltage at ECU
Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

○*The output voltage changes according to the air temperature in the intercooler.*

- Turn the ignition switch OFF.

★If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.

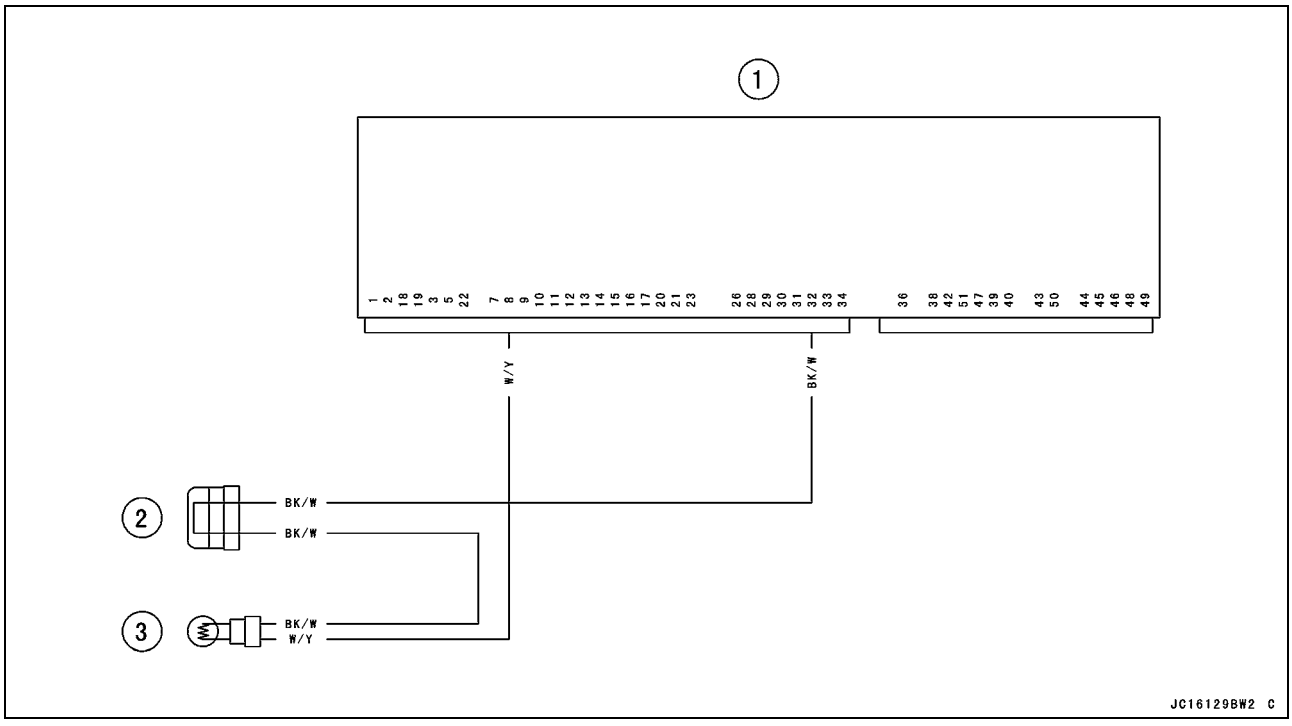
★If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).

★If the wiring is good, check the charging temperature sensor resistance.

- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors

Charging Temperature Sensor (Service Code/Character-19/PrET)



1. ECU
2. Joint Connector 5 (Ground - Sensor)
3. Charging Temperature Sensor

Sensor Resistance Inspection

- Remove the charging temperature sensor (see Charging Temperature Sensor Removal/Installation).
- Refer to Electrical System chapter for charging temperature sensor inspection.

Crankshaft Sensor (Service Code/Character-21/CrAg)

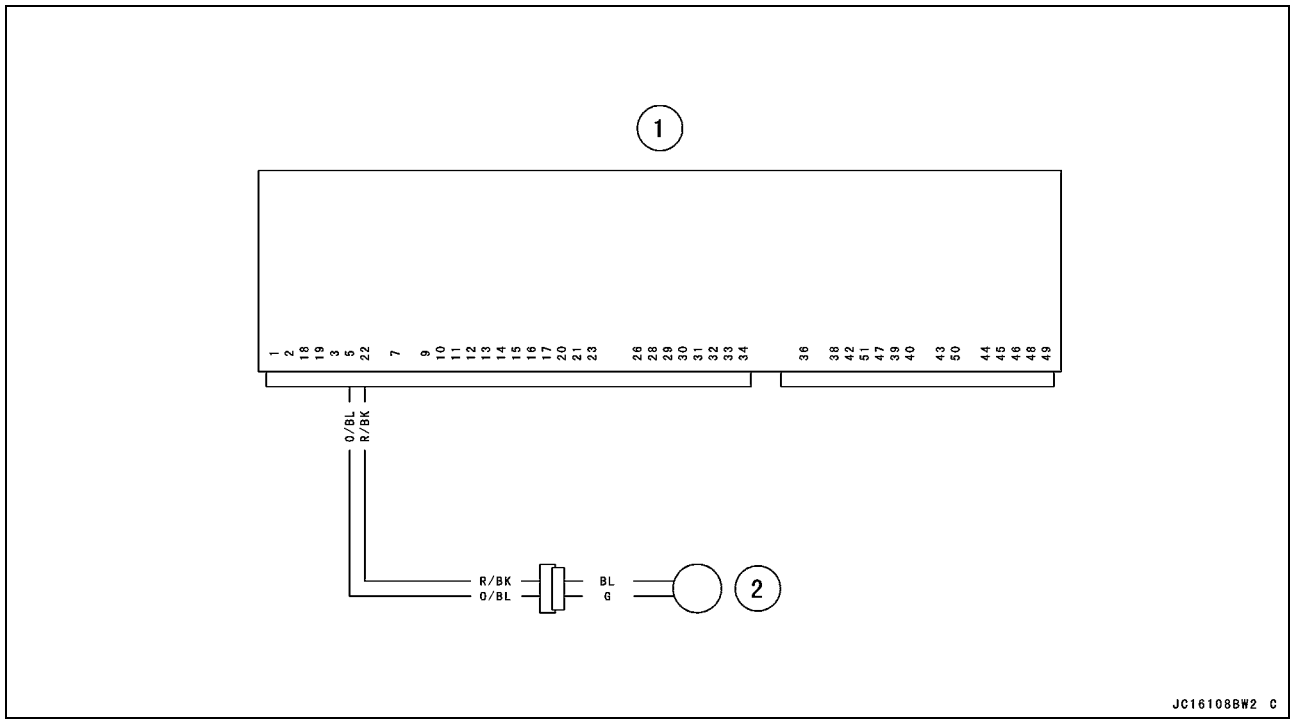
Crankshaft Sensor Removal/Installation

- See the Ignition System section in Electrical System chapter.

Crankshaft Sensor Inspection

○The crankshaft have no power source, and when the engine stops, the crankshaft generates no signals.

- Crank the engine and measure the peak voltage of the crankshaft sensor (see Ignition System section in the Electrical System chapter) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.



1. ECU
2. Crankshaft Sensor

Camshaft Position Sensor (Service Code/Character-23/CAA1)

Camshaft Position Sensor Removal/Installation

The camshaft position sensor detects the position of the camshaft, and distinguishes the cylinder.

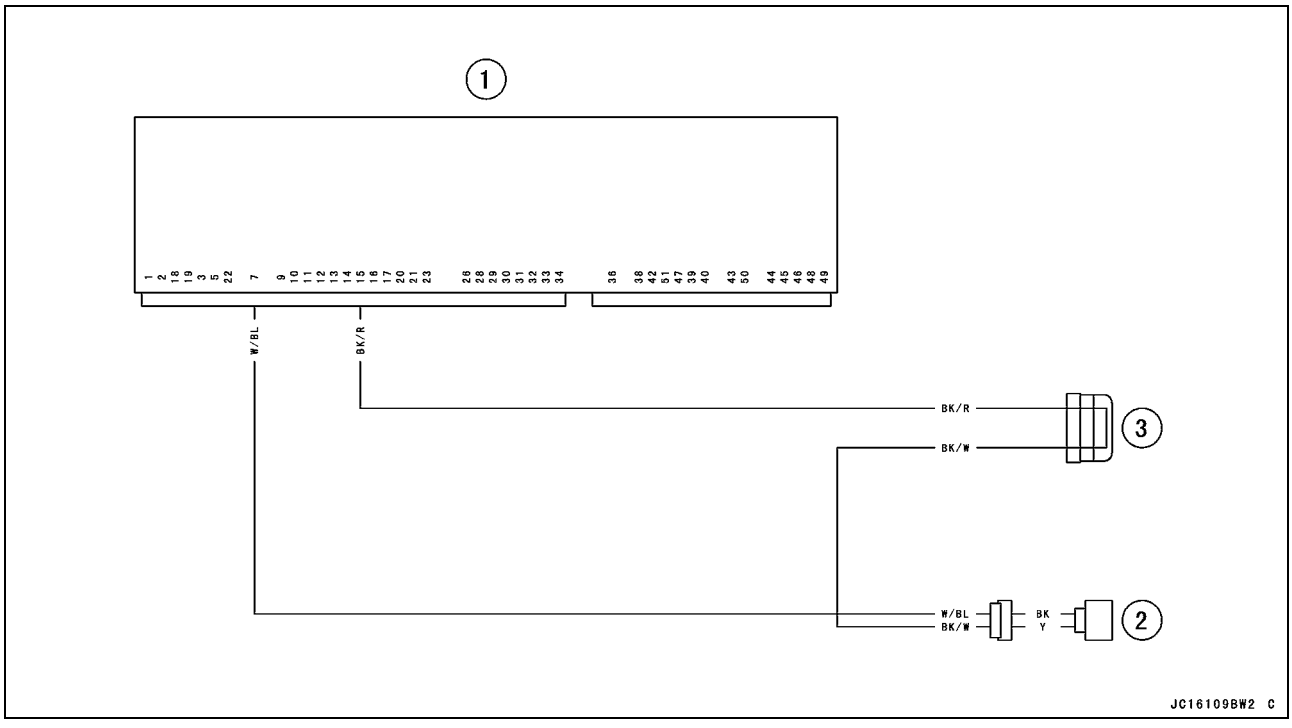
● See Ignition System section in Electric System chapter.

Camshaft Position Sensor Inspection

○The camshaft position sensor have no power source, and when the engine stops, the camshaft position sensor generates no signal.

● Crank the engine and measure the peak voltage of the camshaft position sensor (see Ignition System section in the Electrical System chapter) in order to check the sensor.

● Check the wiring for continuity, using the following diagram.

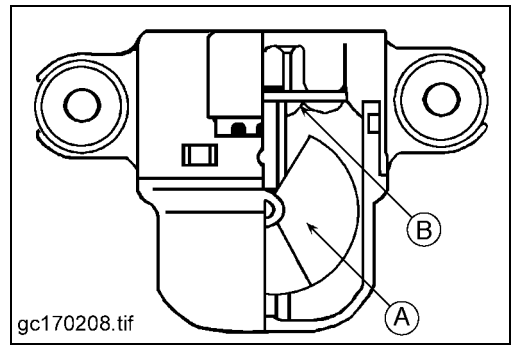


1. ECU
2. Camshaft Position Sensor (Exhaust)
3. Joint Connector 9 (Ground Control)

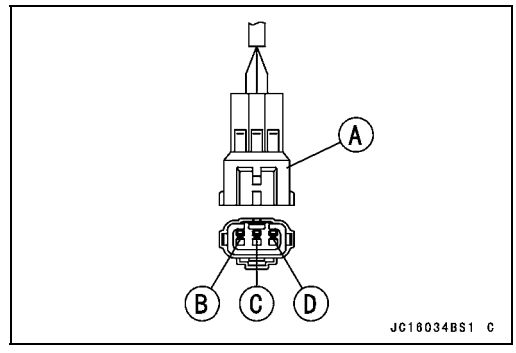
Vehicle-down Sensor (Service Code/Character-31/dOS)

This sensor has a weight [A] with two magnets inside, and sends a signal to the ECU. But when the watercraft banks 110 ~ 130° or more to either side (in fact falls down), the weight turns and shuts off the signal. The ECU senses this change, and stops the fuel pump, the fuel injectors, and the ignition system.

Hall IC [B]



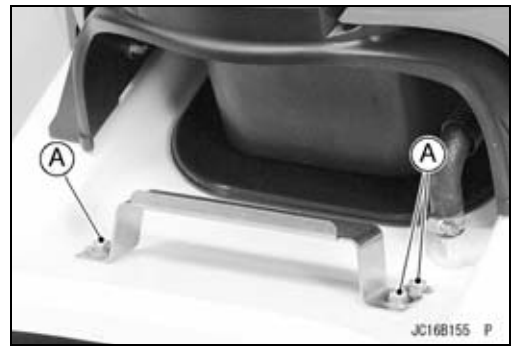
Vehicle-down Sensor Connector [A]
Ground Terminal BK/W [B]
Output Terminal BL/W [C]
Power Source Terminal R/G [D]



Vehicle-down Sensor Removal

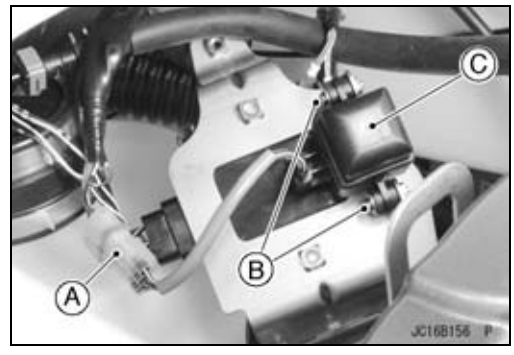
CAUTION

Never drop the down-sensor, especially on a hard surface. Such a shock to the sensor can damage it.



● Remove:
Seat (see Hull/Engine Hood chapter)
Front Storage Pocket (see Hull/Engine Hood chapter)
Bracket Bolts [A] and Washers

● Remove:
Vehicle-down Sensor Connector [A]
Screws [B]
Vehicle-down Sensor [C]

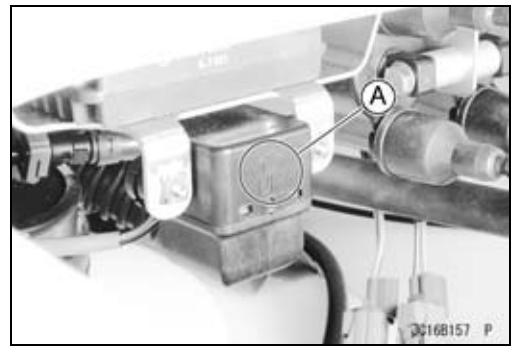


Vehicle-down Sensor Installation

● The UP mark [A] of the sensor should face upward.

⚠ WARNING

Incorrect installation of the vehicle-down sensor could cause sudden loss of engine power. The rider could lose balance during certain riding situations, like leaning over in a turn, with the potential for an accident resulting in injury or death. Ensure that the down sensor is held in place by the sensor brackets.



● Tighten:

Torque - Vehicle-down Sensor Mounting Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

Vehicle-down Sensor (Service Code/Character-31/dOS)

Vehicle-down Sensor Inspection

NOTE

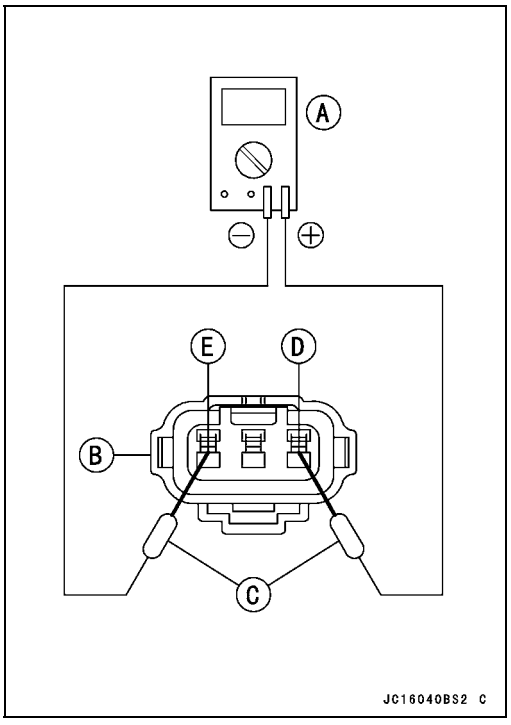
○*Be sure the battery is fully charged.*

● Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).

● Connect a digital volt meter [A] to the connector [B] of the vehicle-down sensor lead with the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Power Source Voltage
Connections to Sensor
Meter (+) → R/G lead [D]
Meter (–) → BK/W lead [E]



● Turn the ignition switch ON and push the lanyard key under the stop button.
● Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor power sours voltage.
○Wait 15 seconds before using the starter again.

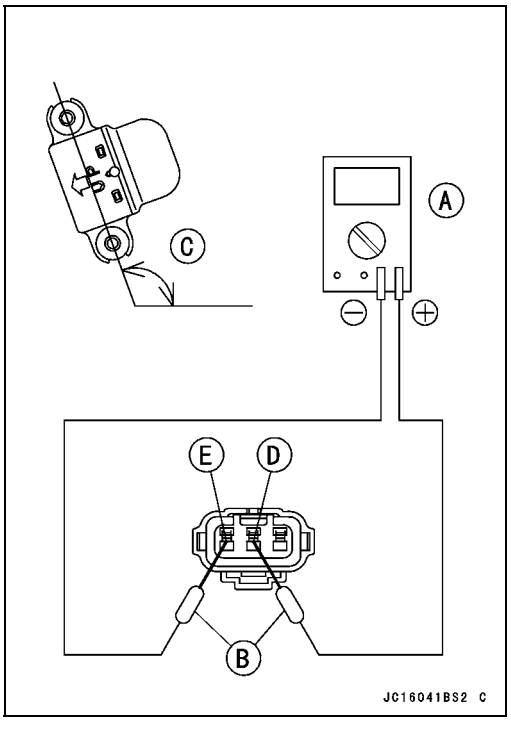
Power Source Voltage at Sensor
Standard: 4.75 ~ 5.25 V

● Turn the ignition switch OFF.
★If there is no standard voltage, check the following:
Battery (see Electrical System chapter)
Main Fuse 20 A
Wiring for Vehicle-down Sensor Power Source (see next diagram)
★If the power source is normal, check the output voltage.

● Turn the ignition switch OFF.
● Remove the vehicle-down sensor. Do not disconnect the connector.
● Connect a digital volt meter [A] to the connector, with needle adapter set [B].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Output Voltage
Connections to Sensor
Meter (+) → BL/W lead [D]
Meter (–) → BK/W lead [E]



● Hold the sensor vertically.
● Turn the ignition switch ON and push the lanyard key under the stop button.
● Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
○Tilt the sensor 110 ~ 130° or more [C] right or left, then hold the sensor and measure the output voltage.
○Wait 15 seconds before using the starter again.

Output Voltage at Sensor
Standard: with sensor tilted 110 ~ 130° or more right or left: 0.65 ~ 1.35 V
with sensor arrow mark pointed up: 3.55 ~ 4.45 V

Vehicle-down Sensor (Service Code/Character-31/dOS)

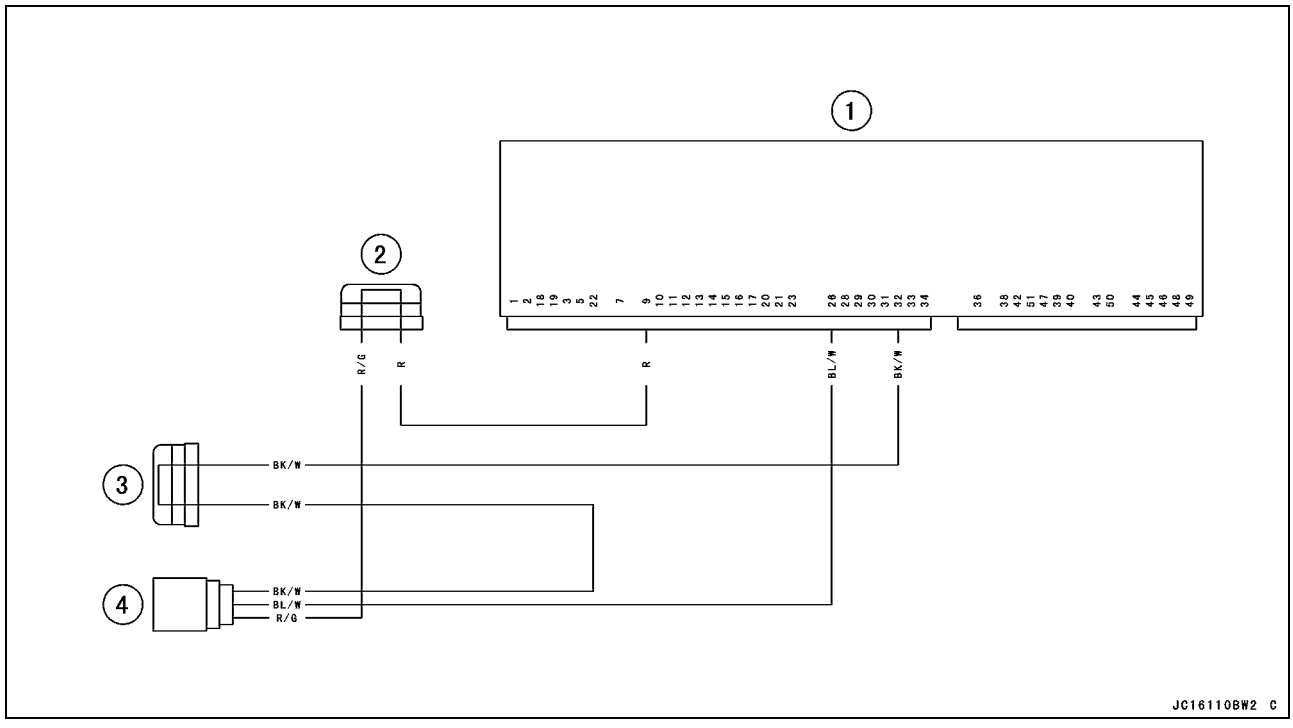
- Turn the ignition switch OFF.
- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of Vehicle-down Sensor Connector

★If the output voltage is normal, the wiring is suspect. Check the wiring.

★If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.

★If the output voltage is out of the specified, replace the vehicle-down sensor.



1. ECU
2. Joint Connector 6 (Power (5 V) - Sensor)
3. Joint Connector 5 (Ground - Sensor)
4. Vehicle Down Sensor

Immobilizer Amplifier (Service Code/Character-35/IdA)

Amplifier Input Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Turn the ignition switch OFF.
- Remove the front access cover (see Front Access Cover Removal in the Hull/Engine Hood chapter).
- Connect a digital meter to the ignition switch connector [A], using the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Ignition Switch Input Voltage
Connections to Connector
Meter (+) → R lead
Meter (–) →BK lead

- Measure the input voltage with the engine stopped, and with the connector joined.
- Turn the ignition switch ON.

Input Voltage
Standard: Battery Voltage

- Turn the ignition switch OFF.

★If the reading is out of the range, check the wiring (see wiring diagram in next section).

★If the reading is good, replace the ignition switch (see Immobilizer System Parts Replacement in the Electrical System chapter).

Key Collation Error (Service Code/Character-36/IdEr)

- This code appears in the following conditions.

○The transponder [A] in the FPO mode and/or SLO mode key is malfunction.

○When the spare key of unregistration is used.

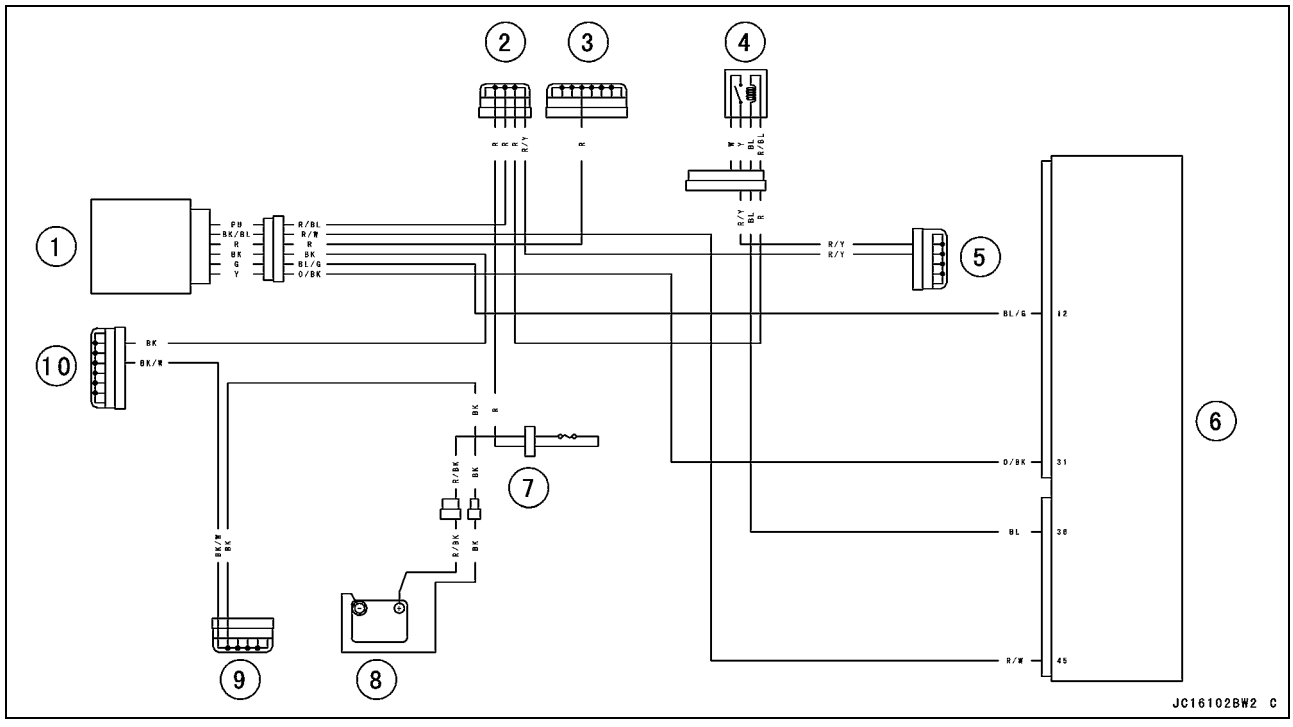
- Therefore, the service code 36 will disappear when the above issue is solved.

User Key Inspection

- Register the user key correctly (see Key Registration in the Electrical System chapter).

★If the service code 36 appears again, the transponder in the key is malfunction, replace it.

Immobilizer System Circuit



1. Ignition Switch (Immobilizer Amplifier)
2. Joint Connector 1
3. Joint Connector 2
4. System Relay
5. Joint Connector 7
6. ECU
7. Main Fuse 20 A
8. Battery
9. Joint Connector 12
10. Joint Connector 15

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)

Ignition Coil #1, #4: Service Code 51-COL1
Ignition Coil #2, #3: Service Code 52-COL2

Ignition Coil Removal/Installation

CAUTION

Never drop the ignition coils, especially on a hard surface. Such a shock to the ignition coil can damage it.

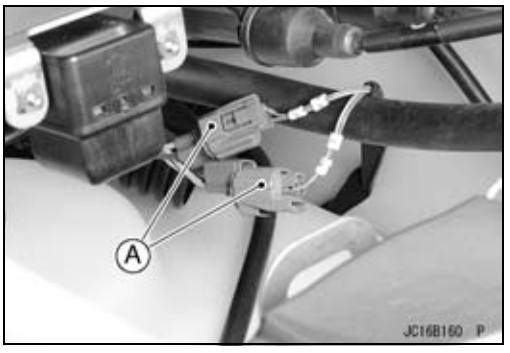
- See Ignition System section in Electrical System chapter.

Input Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Turn the ignition switch OFF.
- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Disconnect the ignition coil primary lead connector(s) [A].

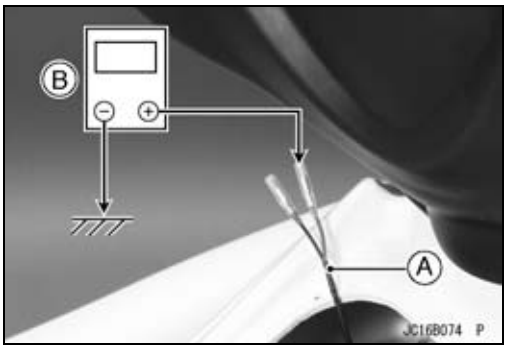


- Connect the harness adapter [A] and a digital voltmeter [B].

Special Tool - Harness Adapter: 57001-1562

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the input voltage.

○Wait 15 seconds before using the starter again.



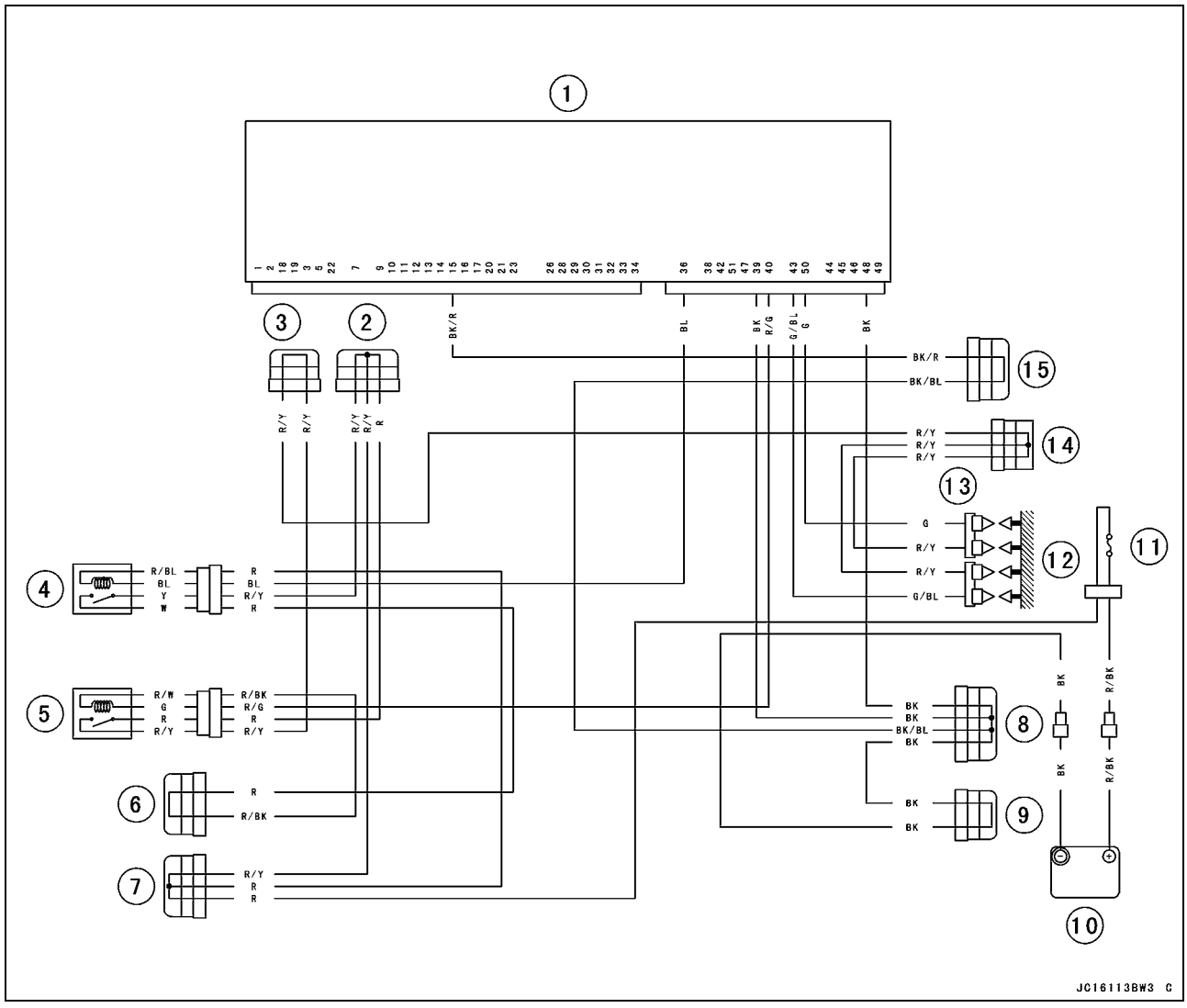
Ignition Coil Input Voltage at Ignition Coil
Connections for Ignition Coil #1, #4
Meter (+) → R/Y lead
Meter (–) → Battery (–) terminal
Connections for Ignition Coil #2, #3
Meter (+) → R/Y lead
Meter (–) → Battery (–) terminal

Input Voltage at ECU
Standard: Battery Voltage

★If the reading is out of the standard, check the wiring (see next wiring diagram).

★If the reading is good, the input voltage is normal. Crank the engine, and check the peak voltage of the ignition coils (see Electrical System chapter) in order to check the primary coils.

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 2
7. Joint Connector 1
8. Joint Connector 11 (Ground)
9. Joint Connector 12 (Ground)
10. Battery
11. Main Fuse 20 A
12. Spark Plugs
13. Ignition Coils
14. Joint Connector 10 (Ignition Coil (12 V))
15. Joint Connector 9 (Ground Control)

Engine Overheating (Service Code/Character-71/HEAt)

● If the service code is displayed, check the doubtful parts referring to the following table.

Possible Causes	Action (Chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Incorrect engine oil level	Inspect (see 4 chapter)
Engine oil poor quality or incorrect	Change (see 4 chapter)
Water temperature sensor broken	Inspect (see 3 and 14 chapters)
Jet pump or impeller damaged	Inspect (see 11 chapter)
Oil cooler clogged	Clean (see 4 chapter)
Carbon build-up on combustion chamber	Clean (see 6 chapter)

Low Engine Oil Pressure (Service Code/Character-72/OILP)

● If the service code is displayed, check the doubtful parts referring to the following table.

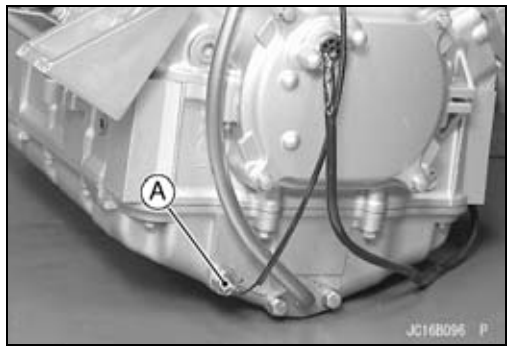
Possible Causes	Action (Chapter)
Oil leak	Inspect (see 4 chapter)
Engine oil level too low	Inspect (see 4 chapter)
Engine oil viscosity too low	Inspect (see 4 chapter)
Oil filter clogged	Clean (see 4 chapter)
Oil pressure switch damaged	Inspect (see 3 and 14 chapters)
Oil cooler clogged	Inspect (see 4 chapter)
Camshaft bearing worn	Inspect (see 6 chapter)
Crankshaft bearing worn	Inspect (see 8 chapter)
Oil pressure relief valve stuck open	Change (see 4 chapter)
Oil pump damaged	Change (see 4 chapter)
Oil screen clogged	Clean (see 4 chapter)
O-ring at the oil passage in the crankcase damaged	Change (see 4 chapter)

Oil Temperature Sensor (Service Code/Character-73/OILt)

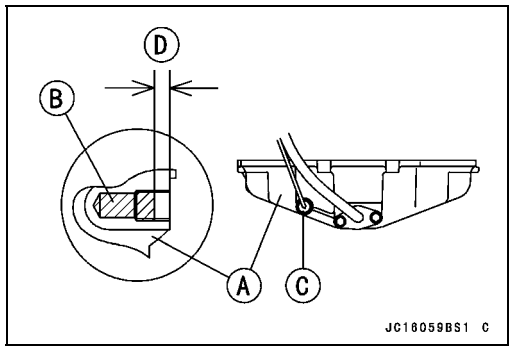
Oil Temperature Sensor Removal/Installation

CAUTION

Never drop the sensor, especially on a hard surface. Such a shock to the sensor can damage it.



- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Oil Temperature Sensor [A]



- Fill the hollow of the oil pan [A] with the specified silicone grease [B] as shown, before installing the oil temperature sensor [C].
  [D] 5 mm (0.2 in.)

  Silicone Grease-Kawasaki Bond: 92137-1002

- Tighten:

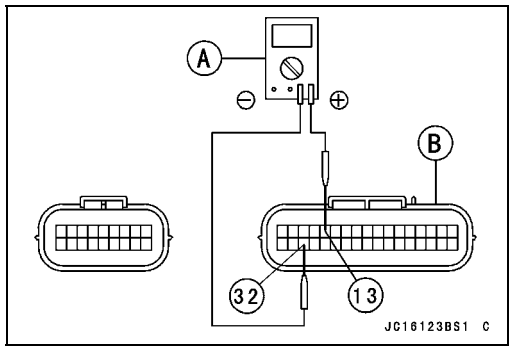
  Torque - Oil Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)

Output Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

- Remove the ECU (see ECU Removal). Do not disconnect the connector.



- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.

  Special Tool - Needle Adapter Set: 57001-1457

  Water Temperature Sensor Output Voltage
  Connections to ECU
  Meter (+) → Y lead (terminal 13)
  Meter (–) → BK/W lead (terminal 32)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.

○Wait 15 seconds before using the starter again.

Output Voltage at ECU
Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

○*The output voltage changes according to the oil temperature in the engine.*

Oil Temperature Sensor (Service Code/Character-73/OILt)

- Turn the ignition switch OFF.

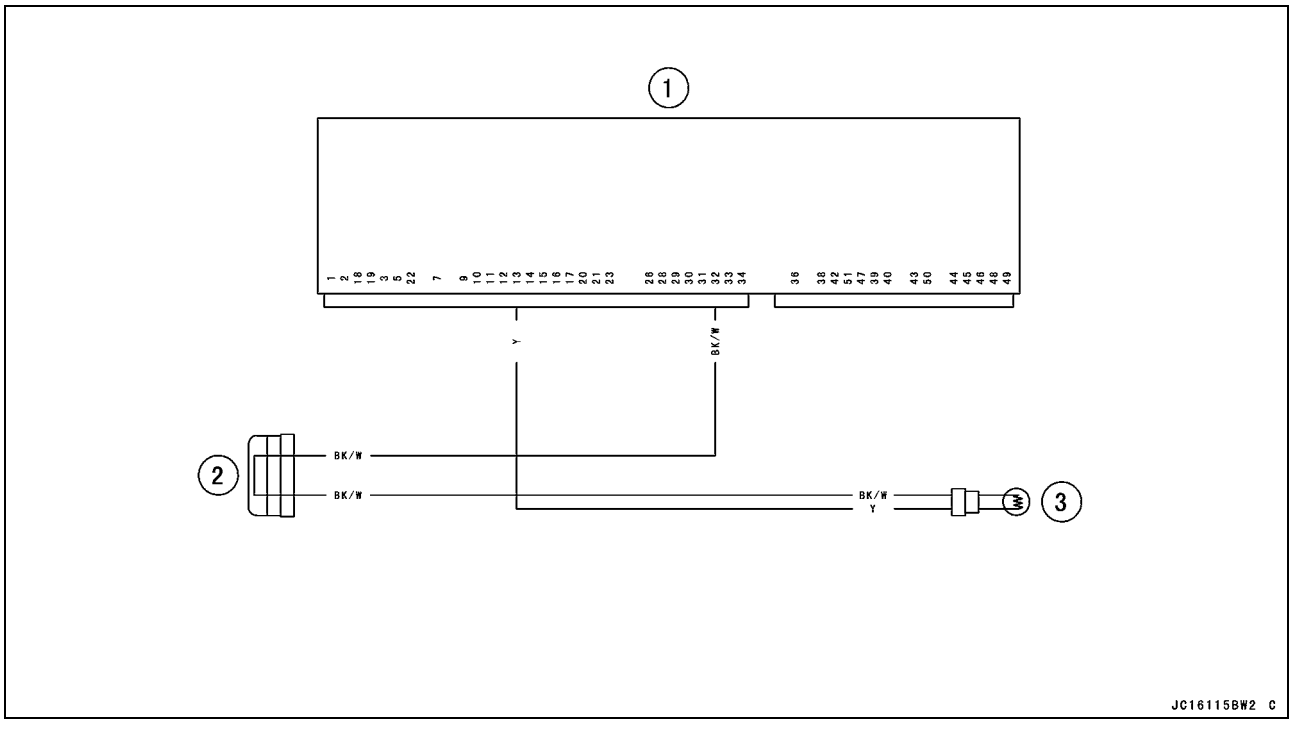
★If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.

★If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).

★If the wiring is good, check the oil temperature sensor resistance.

- Remove the needle adapter set, and apply silicone sealant to the seals of the connector for waterproofing.

Silicone Sealant (Kawasaki Bond: 56019-120) -Seals of ECU Connectors



1. ECU
2. Joint Connector 5 (Ground - Sensor)
3. Oil Temperature Sensor

Sensor Resistance Inspection

- Remove the oil temperature sensor (see Oil Temperature Sensor Removal/Installation).
- Refer to Electrical System chapter for oil temperature sensor inspection.

Main (ECU) Relay and System Relay (Service Code/Character-75/rEL)

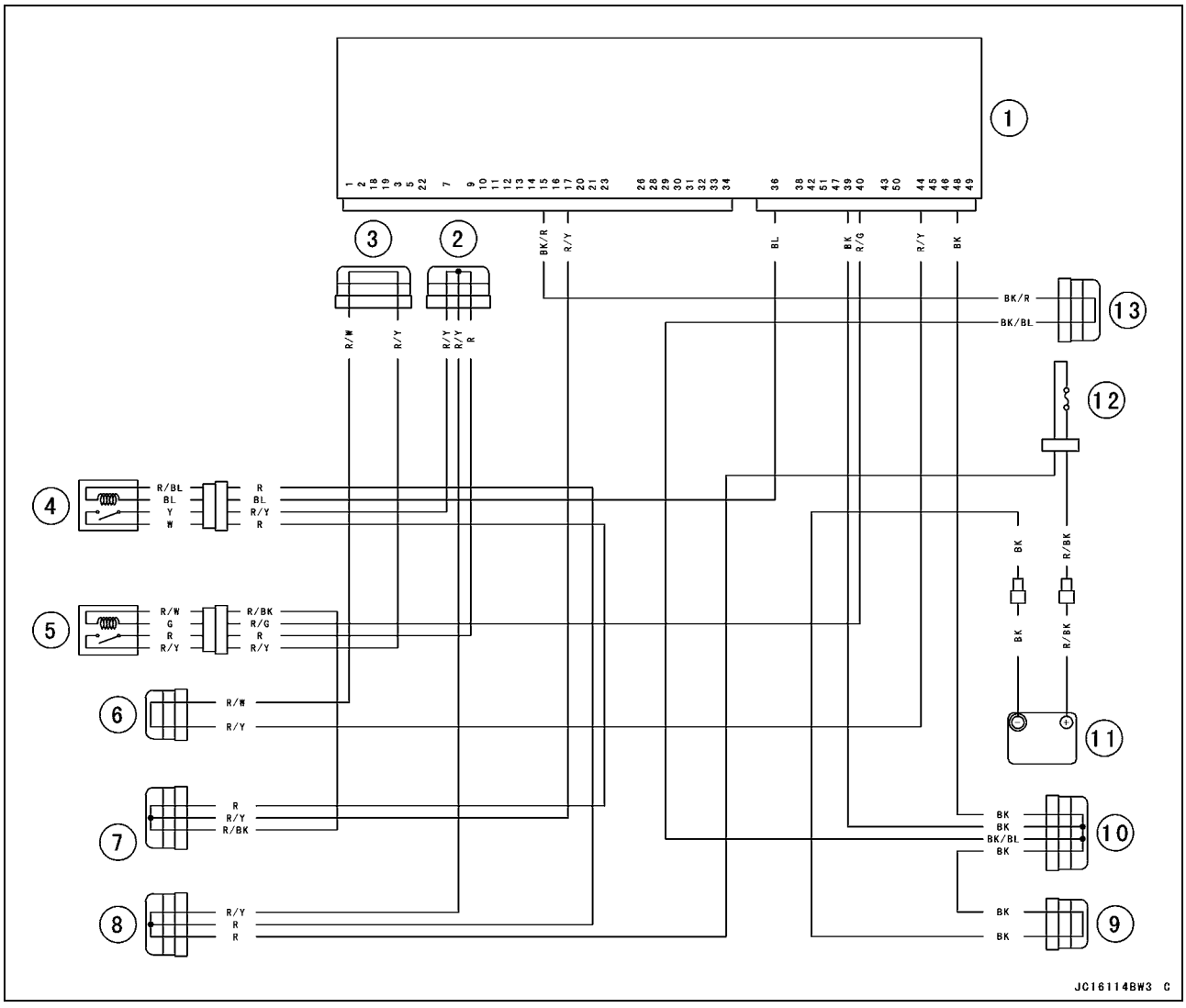
Relay Assembly Removal

CAUTION
Never drop the relay, especially on a hard surface. Such a shock to the relay can damage it.

- Refer to Relay Assembly Removal in the Electrical System chapter.

Relay Assembly Inspection

- Refer to Relay Assembly Inspection in the Electrical System chapter.



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 3 (Switch (12 V))
7. Joint Connector 2
8. Joint Connector 1
9. Joint Connector 12 (Ground)
10. Joint Connector 11 (Ground)
11. Battery
12. Main Fuse 20 A
13. Joint Connector 9 (Ground Control)

Engine Oil Overheating (Service Code/Character-76/OILH)

● If the service code is displayed, check the doubtful parts referring to the following table.

Possible causes	Action (Chapter)
Incorrect engine oil level	Inspect (see 4 chapter)
Engine oil poor quality or incorrect	Change (see 4 chapter)
Oil temperature sensor broken	Inspect (see 3 and 14 chapters)
Oil cooler clogged	Clean (see 4 chapter)
Oil pump malfunction	Inspect (see 4 chapter)
Relief valve malfunction	Inspect (see 4 chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Weeds or debris in jet pump	Inspect (see 11 chapter)

Charging (Intake) Temperature Overheating (Service Code/Character-78/CHAr)

● If the service code is displayed, check the doubtful parts referring to the following table.

Possible Causes	Action (Chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Charging temperature sensor broken	Inspect (see 3 and 14 chapters)
Jet pump or impeller damaged	Inspect (see 11 chapter)
Intercooler clogged	Clean (see 9 chapter)
Air bypass valves broken	Inspect (see 3 chapter)

Fuel Injectors

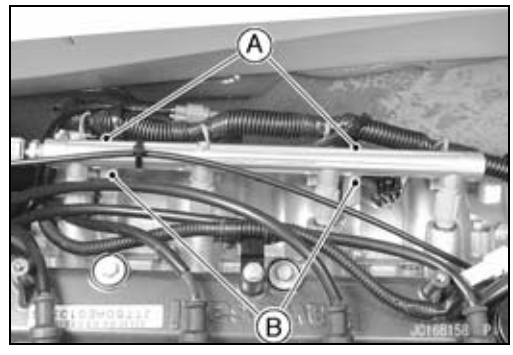
Fuel Injector Removal

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Turn the ignition switch OFF. Disconnect the battery (–) cable terminal. Do not smoke. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.
Be prepared for fuel spillage: any spilled fuel must be completely wiped up immediately.

- Pull up the spark plug leads [A] and place them out of the engine compartment.
- Disconnect the fuel hose from the delivery pipe (see Fuel Hose Removal).
- Disconnect the upper air bypass duct [B].

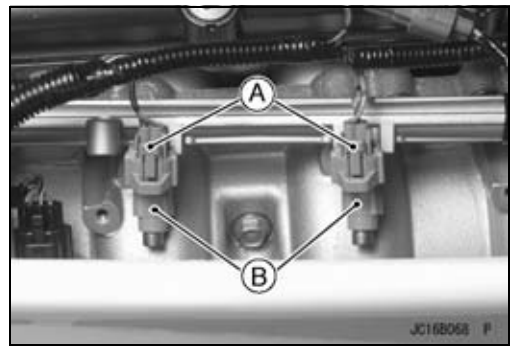
- Remove:
  Delivery Pipe Mounting Bolts [A], Collars [B] and Clamps
- Remove the delivery pipe assembly from the cylinder head.



- Push the lock [A] and disconnect the injector connectors.
- Remove the fuel injectors [B].

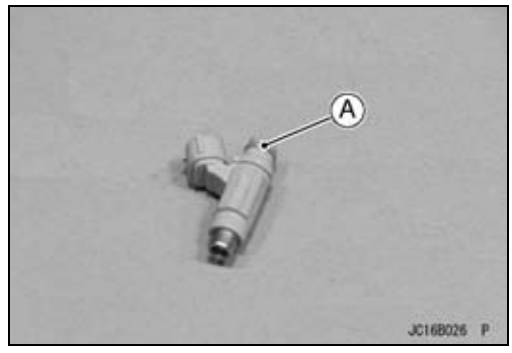
CAUTION

Never drop the injector, especially on a hard surface. Such a shock to the injector can damage it.

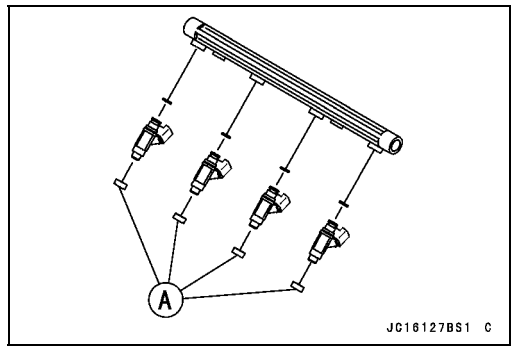


Fuel Injectors

Fuel Injector Installation



- Replace the O-rings [A] of the injectors with new ones.
- Apply grease to the O-rings.
- Insert the injectors into the delivery pipe and confirm whether they turn smoothly or not.



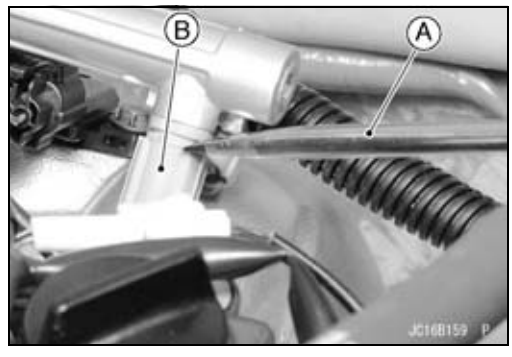
- Replace the seals [A] with new ones.
- Apply grease to the inside and outside of seals.

- Install:
  Delivery Pipe Assembly
  Collars
- Tighten:

Torque - Delivery Pipe Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install the fuel hose (see Fuel Hose Installation).
- Route the fuel hose correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).

Audible Inspection



- Start the engine.
- Apply the tip of a screwdriver [A] to the injector [B]. Put the grip end onto your ear, and listen whether the injector is clicking or not.
- A sound scope can also be used.
- Do the same for the other injector.

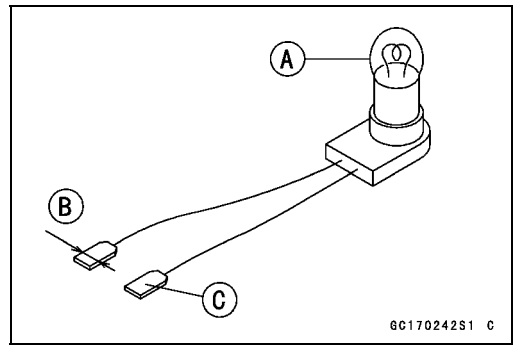
★If all the injectors click at a regular intervals, the injectors are good.

○The click interval becomes shorter as the engine speed rises.

★If either injector doesn't click, perform the "Injector Signal Test" for injector operation.

Fuel Injectors

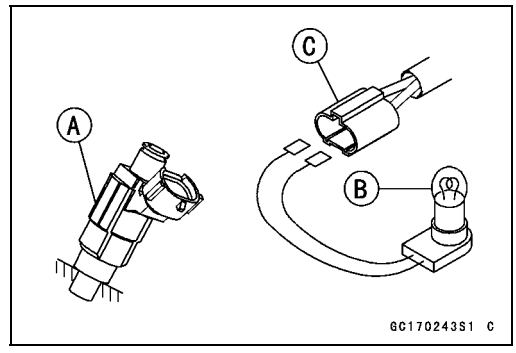
Injector Signal Test



- Prepare four test lights set with male terminals as shown.
  Rating of Bulb [A]: 12 V, 3 ~ 3.4 W
  Terminal Width [B]: 1.8 mm (0.07 in.)
  Terminal Thickness [C]: 0.8 mm (0.03 in.)

CAUTION

Do not use larger terminals than specified above. A larger terminal could damage the injector main harness connector, leading to harness repair or replacement.



- Remove connectors for injector [A].
- Connect each test light set [B] to the injector harness connector [C].
- Turn the ignition switch ON.
- While cranking the engine with the starter motor, watch the test lights.

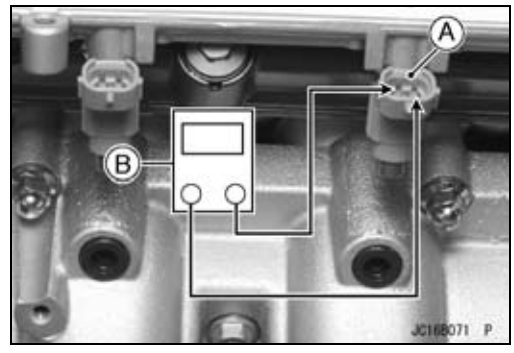
★If the test lights flicker at regular intervals, the injector circuit in the ECU and the wiring are good. Perform the “Injector Resistance Inspection”.

○Injector signals can be also confirmed by connecting the hand tester (× 10 V AC) instead of the test light set to the injector harness (female) connector. Crank the engine with the starter motor, and check to see if the hand oscillates at regular intervals.

Special Tool - Hand Tester: 57001-1394

★If the test light doesn’t flicker (or the test hand doesn’t oscillates), check the wiring and connectors again. If the wiring is good, check the injector voltage.

Injector Resistance Inspection



- Remove the delivery pipe assembly.
- Disconnect the connector from the injector [A].
- Measure the injector resistance with the hand tester [B].

Special Tool - Hand Tester: 57001-1394

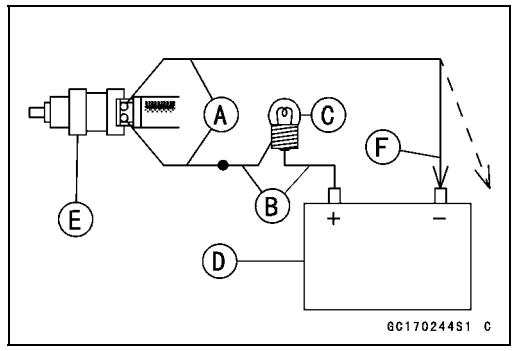
Injector Resistance
Standard: about 11.7 ~ 12.3 Ω @20°C (68°F)

★If the reading is out of the range, perform the “Injector Unit Test”.

★If the reading is normal, perform the “Injector Unit Test” for confirmation.

Fuel Injectors

Injector Unit Test



- Use two leads [A] and the same test light set [B] as in "Injector Signal Test".
  Rating of Bulb [C]: 12 V, 3 ~ 3.4 W
  12 V Battery [D]

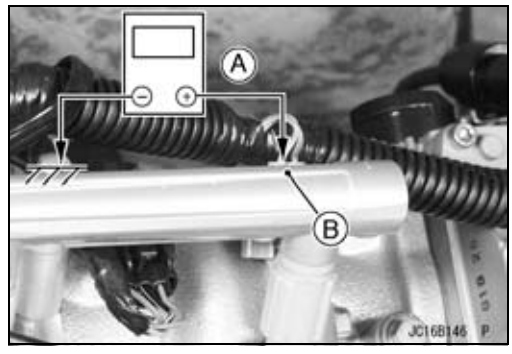
CAUTION

Be sure to connect the bulb in series. The bulb works as a current limiter to protect the solenoid in the injector from excessive current.

- Connect the test light set to the injector [E] as shown.
- Open and connect [F] the end of the lead to the battery (–) terminal repeatedly. The injector should click.

★If the injector does not click, replace the injector.

Injector Voltage Inspection



- Turn the ignition switch OFF.
- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Injector Power Source Voltage
Connector to Injector #1, #2, #3, #4
Meter (+) → R/Y lead
Meter (–) → Battery (–) Terminal

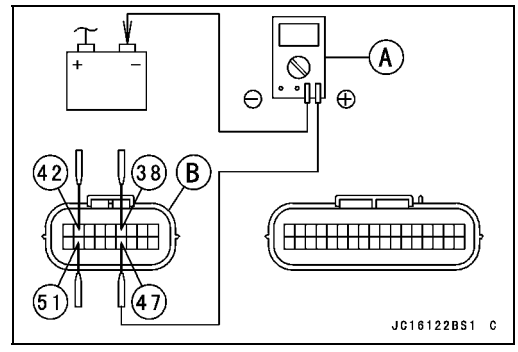
- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the injector power source voltage.

○Wait 15 seconds before using the starter again.

Power Source Voltage at Injector Connector
Standard: Battery Voltage

★If the power source voltage is less than standard, check the wiring (see Wiring Diagram in this section), relay (Main Relay Inspection) and ECU power source (see ECU Power Supply Inspection).

Fuel Injectors



- Remove the ECU. Do not disconnect the connector.
- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Injector Output Voltage
Connections to Injector #1
Meter (+) → PU lead (terminal 42)
Meter (–) → Battery (–) Terminal
Connections to Injector #2
Meter (+) → O lead (terminal 51)
Meter (–) → Battery (–) Terminal
Connections to Injector #3
Meter (+) → BR lead (terminal 38)
Meter (–) → Battery (–) Terminal
Connections to Injector #4
Meter (+) → BL/Y lead (terminal 47)
Meter (–) → Battery (–) Terminal

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the output voltage.

○Wait 15 seconds before using the starter again.

Output Voltage at Injector Connector
Standard: about 9 V or more

★If the output voltage is out of the standard, replace the ECU.

Fuel Injectors

Injector Fuel Line Inspection

- Check the injector fuel line for leakage as follows:

○Connect a commercially available vacuum/pressure pump [A] to the supply joint of the delivery pipe [B] with the fuel hose [C] (supply ends connected with the clamp [D]) as shown.

○Apply soap and water solution to the areas [E] as shown.

○Watching the pressure gauge, squeeze the pump lever [H], and build up the pressure until the pressure reaches the maximum pressure.

Fuel Line Maximum Pressure
Standard: 300 kPa (3.06 kgf/cm², 44 psi)

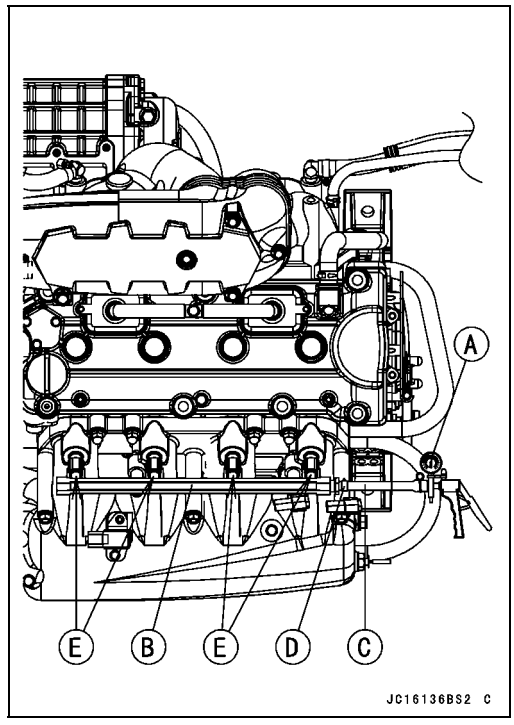
CAUTION
During pressure testing, do not exceed the maximum pressure for which the system is designed.

○Watch the gauge for at least 6 seconds.

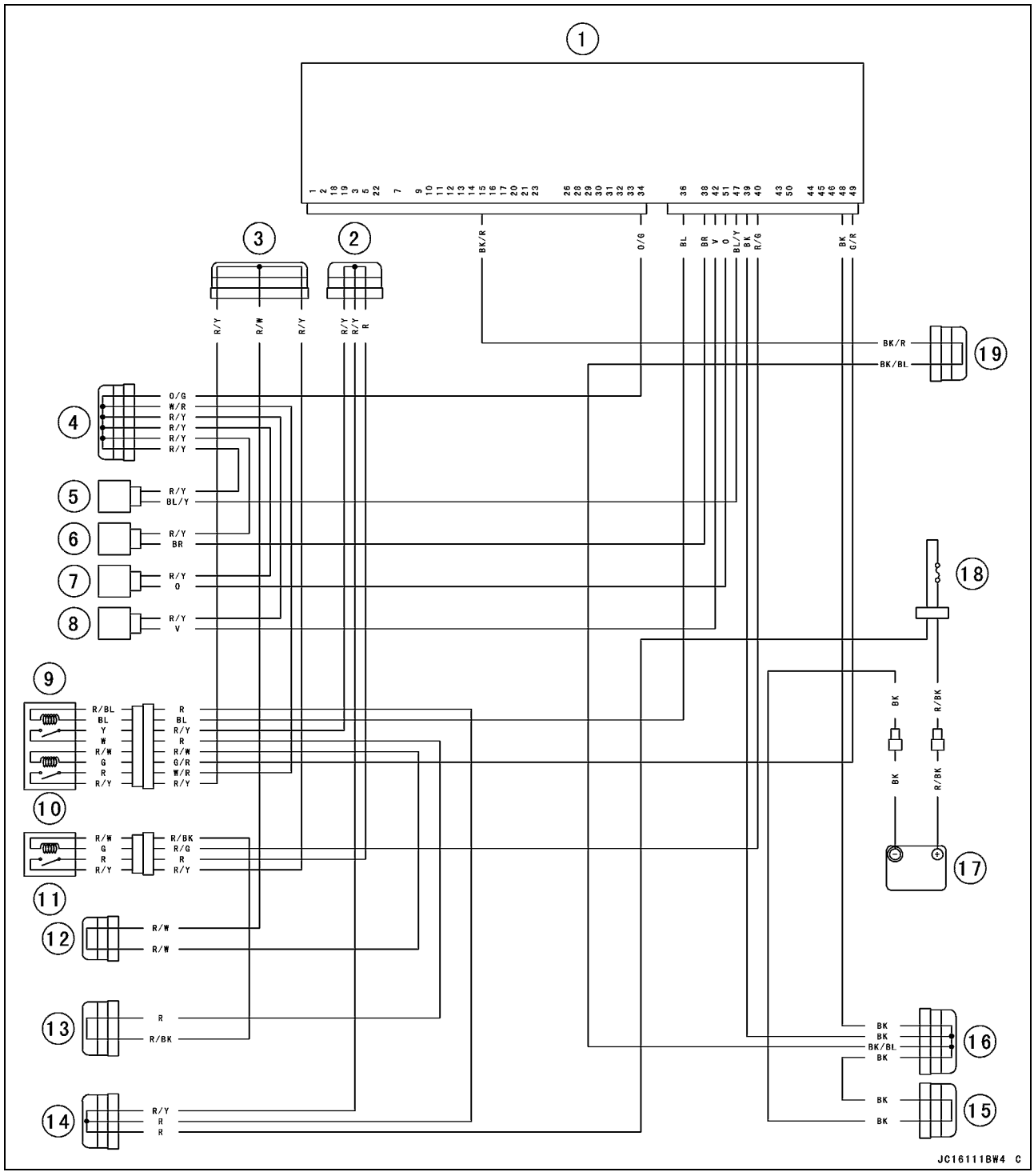
★If the pressure holds steady, the system is good.

★If the pressure drops at once, or if bubbles are found in the area, the line is leaking. Replace the delivery pipe, injectors and related parts.

- Repeat the leak test, and check the fuel line for no leakage.
- Run the hoses correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).



Fuel Injectors



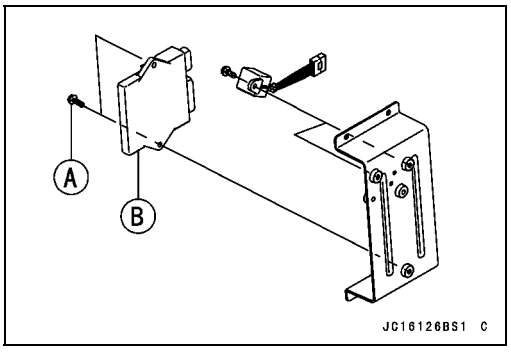
1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. Joint Connector 4 (Power (12V) - Injector)
5. Injector #4
6. Injector #3
7. Injector #2
8. Injector #1
9. System Relay
10. Fuel Pump Relay
11. Main (ECU) Relay
12. Joint Connector 3 (Switch (12 V))
13. Joint Connector 2
14. Joint Connector 1
15. Joint Connector 12 (Ground)
16. Joint Connector 11 (Ground)
17. Battery
18. Main Fuse 20 A
19. Joint Connector 9 (Ground Cntrol)

ECU

CAUTION

Never drop the ECU, especially on a hard surface. Such a shock to the ECU can damage it.

ECU Removal



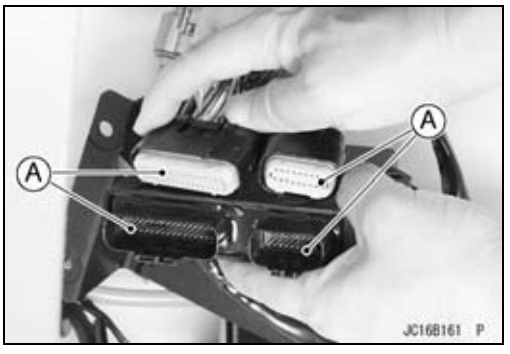
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Front Access Cover (see Front Access Cover Removal/Installation in the Hull/Engine Hood chapter)
  ECU Lead Connector
  Mounting Bolts [A]
  ECU [B]

ECU Installation

- Connect the ECU connector and install it.
- Apply a non-permanent locking agent to the bolts and tighten them.

Torque - ECU Mounting Bolts: 3.0 N·m (0.30 kgf·m, 27 in·lb)

ECU Power Supply Inspection

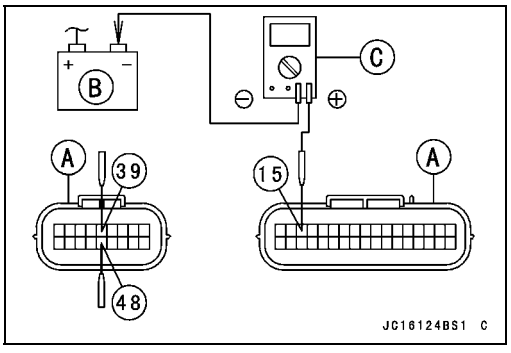


- Visually inspect the terminals [A] of the ECU connectors.

★If the connector is clogged with mud or dust, blow it off with compressed air.

★Replace the main harness if the terminals of the main harness connector is cracked, bent, or otherwise damaged.

★Replace the ECU if the terminals of the ECU connector is cracked, bent, or otherwise damaged.



- With the ECU connector [A] connected, check the following ground lead for continuity with the ignition switch OFF, using a tester and needle adapter set.
  [B] Battery
  [C] Tester

Special Tool - Needle Adapter Set: 57001-1457

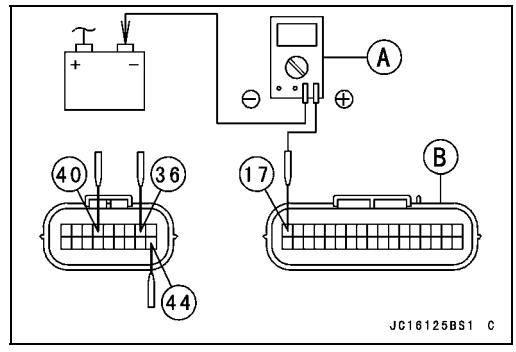
ECU Grounding Inspection

15 (BK/R), 39, 48 (BK) ←→ Battery (–) Terminal: 0 Ω
Terminal

Engine Ground ←→ Battery (–) Terminal: 0 Ω

★If no continuity, check the connector, the engine ground lead, or main harness, and repair or replace them if necessary.

ECU



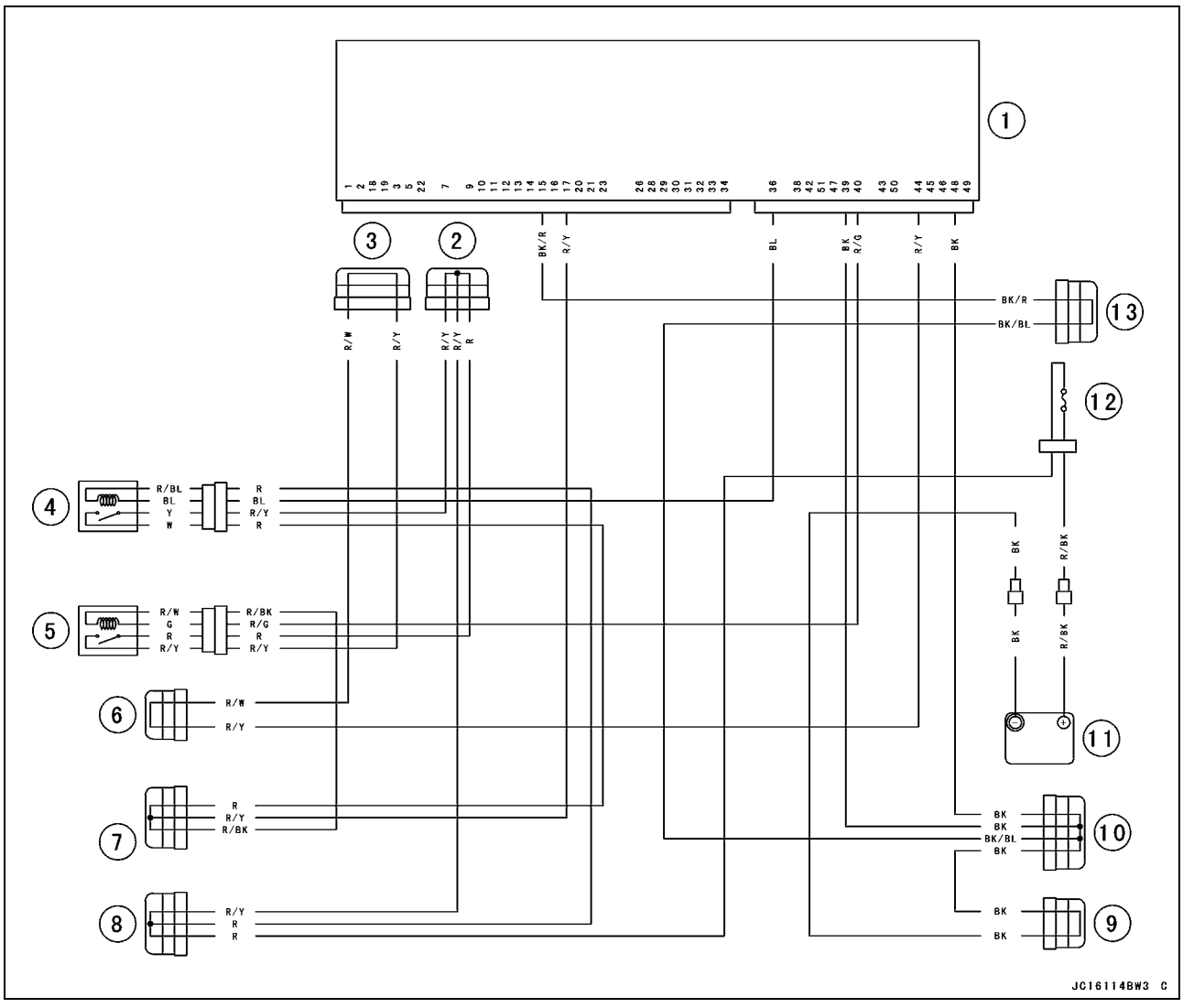
● Check the ECU power source voltage with a tester [A].
○Position the terminal in accordance with terminal numbers of ECU connector [B] in this chapter figure.

ECU Power Source Inspection
Tester Connections:
17 (R/Y) Terminal – Battery (−) Terminal
36 (BL) Terminal – Battery (−) Terminal
40 (R/G) Terminal – Battery (−) Terminal
44 (R/Y) Terminal – Battery (−) Terminal
Terminal Voltage:
Ignition Switch OFF:
17 (R/Y) Terminal → Battery Voltage
36 (BL) Terminal → 0 V
40 (R/G) Terminal → 0 V
44 (R/Y) Terminal → 0 V
Ignition Switch ON:
17 (R/Y) Terminal → Battery Voltage
36 (BL) Terminal → Battery Voltage
40 (R/G) Terminal → 0 V
44 (R/Y) Terminal → 0 V
Ignition Switch ON and Start Button ON:
All Terminals → Battery Voltage

○Pushing the start button, run the engine 3 ~ 4 seconds.
○Wait 15 seconds before using the starter again.
★If the tester does not read as specified, check the following:
Power Source Wiring (see wiring diagram below)
Main Fuse 20 A (see Electrical System chapter)
ECU Main Relay (see DFI Power Source section)
Ignition Switch (see Electrical System chapter)
Start Switch (see Electrical System chapter)

ECU

ECU Power Source Circuit



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 3 (Switch (12 V))
7. Joint Connector 2
8. Joint Connector 1
9. Joint Connector 12 (Ground)
10. Joint Connector 11 (Ground)
11. Battery
12. Main Fuse 20 A
13. Joint Connector 9 (Ground Control)

DFI Power Source

Main Fuse Inspection

- Refer to the Electrical System chapter for the ECU Fuse Inspection.

Relay Assembly Removal

CAUTION
Never drop the relay, especially on a hard surface. Such a shock to the relay can damage it.

- Refer to the Relay Assembly Removal in the Electrical System chapter.

Relay Assembly Inspection

- Refer to the Relay Assembly Inspection in the Electrical System chapter.

Throttle Lever, Cable and Case

Free Play Inspection

- Refer to Throttle Control System Inspection in the Periodic Maintenance chapter.

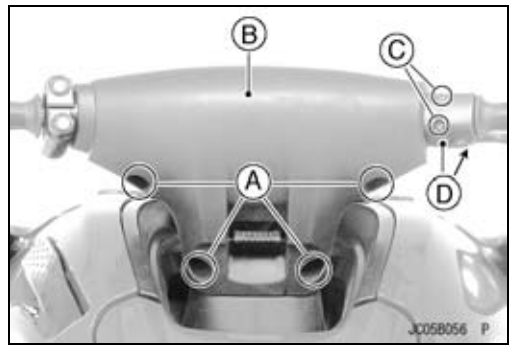
Throttle Cable Adjustment

- Refer to Throttle Cable Adjustment in the Periodic Maintenance chapter.

Throttle Case Removal/Disassembly

- Unscrew the mounting screws [A] and remove the handlebar pad [B].
- Remove the throttle case.

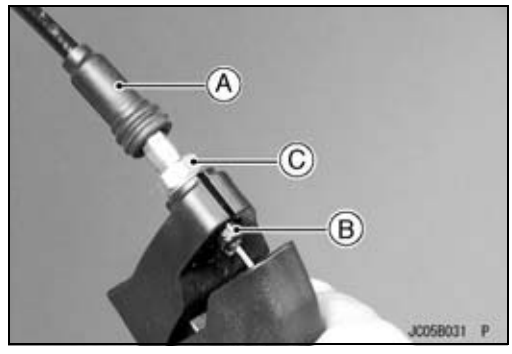
○Unscrew the throttle case mounting screws [C] separate the case halves [D].



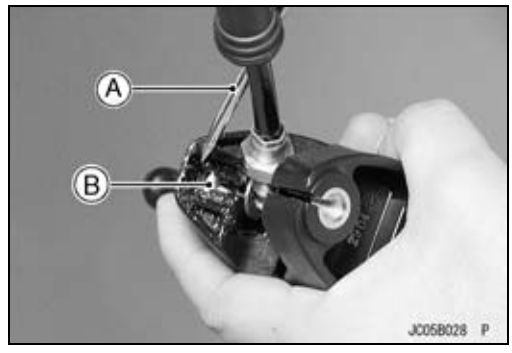
- Disconnect the throttle cable from the case.

○Slide the rubber boots [A] and rubber cap [B] out of the place.

○Unscrew the throttle cable fitting nut [C].

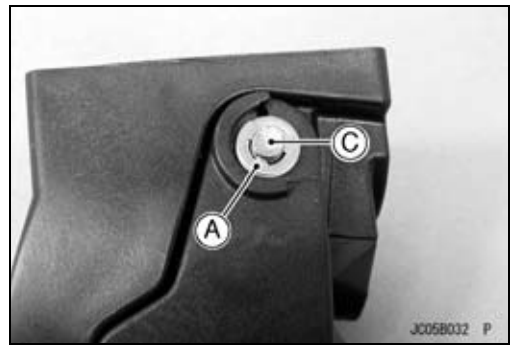


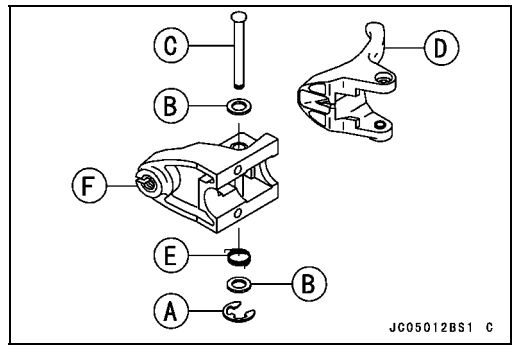
○Use a screw driver [A] to separate the tip [B] of the cable end from the case body.



Throttle Lever, Cable and Case

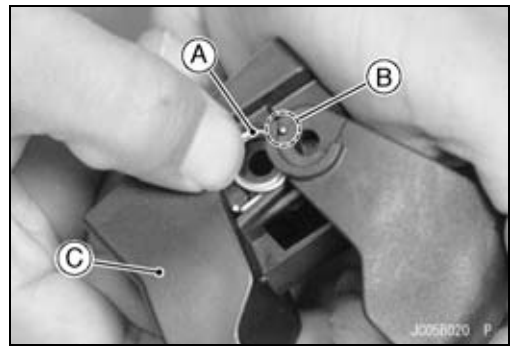
● Disassemble the throttle case.
○Remove the circlip [A], flat washers [B], pin [C], throttle lever [D] and return spring [E] from the case [F].



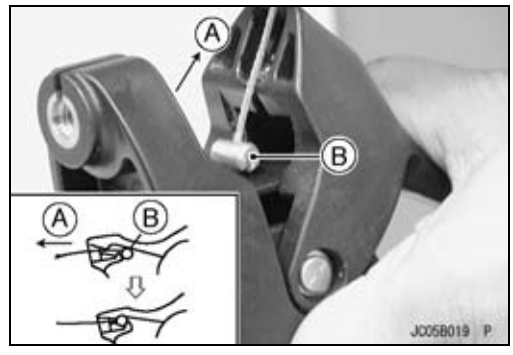


Throttle Case Assembly/Installation

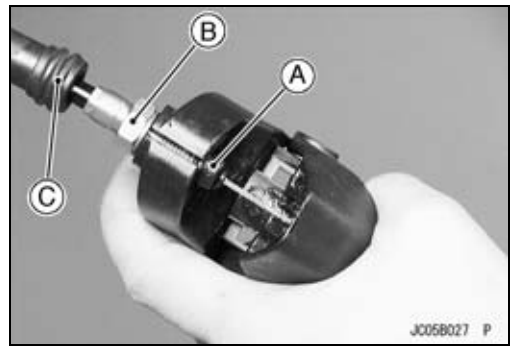
● Insert the end of the return spring [A] in the throttle lever hole [B] and set the spring in the throttle case [C] as shown.
● Install the control lever to the case.



● Lubricate the throttle cable before assembly/installation.
● Apply water resistant grease to the tips of the throttle cable end.
● Pulling the throttle cable [A], position the tips [B] of the cable end as shown.
● Tighten the cable fitting nut.



● Be sure the rubber cap [A] is in place on the throttle cable fitting nut end.
● Cover the cable fitting nut [B] with the rubber boot [C].



Throttle Lever, Cable and Case

- Tighten:

Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 34 in·lb)

- Swing the throttle lever so that the throttle valve is fully open.

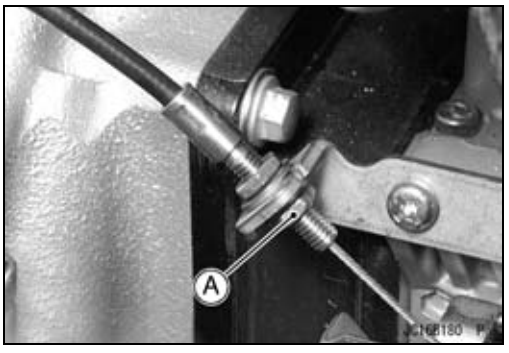
⚠ WARNING

Operation with an improperly assembled throttle case could result in an unsafe riding condition.

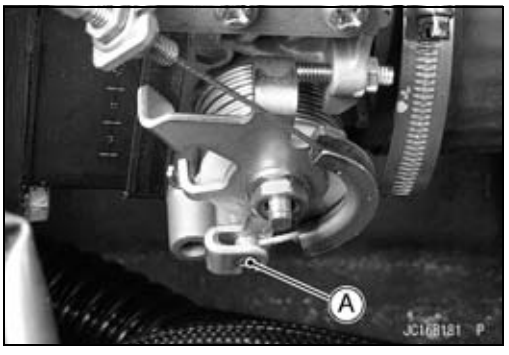
- Adjust the throttle cable (see Throttle Cable Adjustment).

Throttle Cable Removal

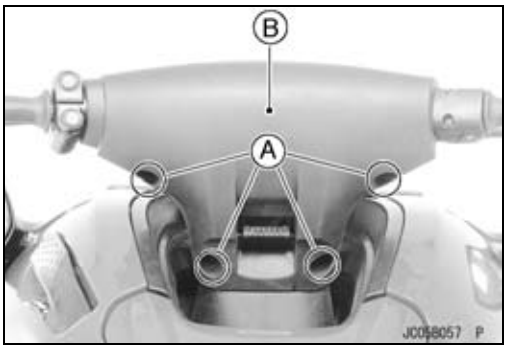
- Disconnect the throttle cable from the body assy.
- ○Slide out the rubber cap.
- ○Unscrew the adjuster locknut [A] and slide the cable from the bracket.



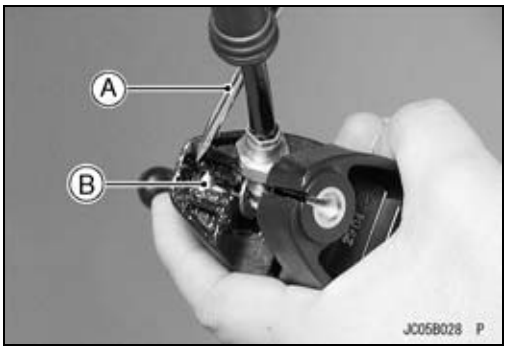
- ○Slide the tip [A] of the cable lower end from the throttle pivot arm.



- Unscrew the mounting screws [A] and remove the handlebar pad [B].
- Take out the inner pad

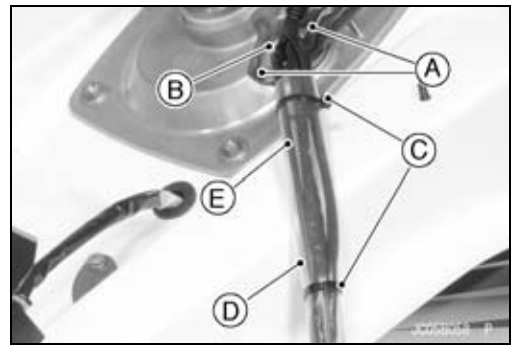


- Remove the throttle case (see Throttle Case Removal).
- Slide the rubber boot out of the place.
- Unscrew the throttle cable fitting nut.
- Remove the upper end of the cable from the case.
- ○Use a screw driver [A] to separate the cable tip [B] from the throttle lever catch.



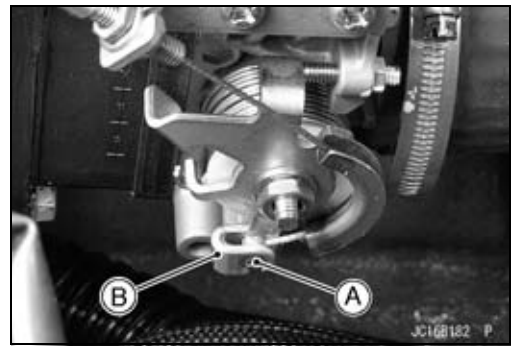
Throttle Lever, Cable and Case

- Remove the steering cover (see Steering Removal in Steering chapter).
- Unscrew the grommet mounting bolts [A] and pull out the plate [B] and grommet.
- Cut off the clamps [C] and remove the protect tube [D].
- Take the throttle cable [E] off the grommet.
- Pull down the throttle cable.



Throttle Cable Installation

- Lubricate the outside of the new cable with a penetrating rust inhibitor to ease cable installation.
- Slide the tip [A] of the cable lower end on the throttle pivot arm [B].



- Tighten:

Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 34 in·lb)

- Route the following correctly (see Cable, Wire, and Hose Routing in Appendix chapter).
  Throttle Cable
  Steering Cable
  Fuel Tank Vent Hose
  Start/Stop Switch Leads
  Buzzer Leads
  Multifunction Meter Leads
- Adjust the following.
  Throttle Cable
- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by return spring.

★If the throttle lever does not return properly, check the throttle routing, cable adjustments, and cable damage. Then lubricate the throttle cable.

- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.

★If the idle speed increases, check the throttle cable adjustment and the cable routing.

Throttle Case and Cable Lubrication

- Refer to the Lubrication in the Periodic Maintenance chapter.

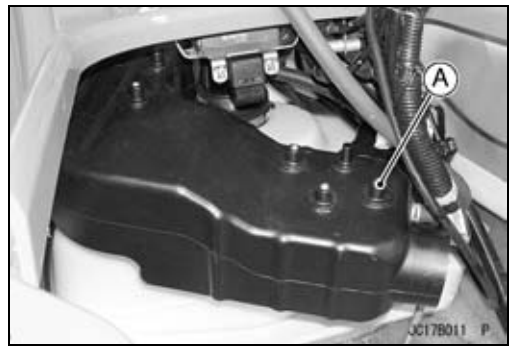
Throttle Cable Inspection

- Refer to the Lubrication in the Periodic Maintenance chapter.

Air Box

Air Box Removal

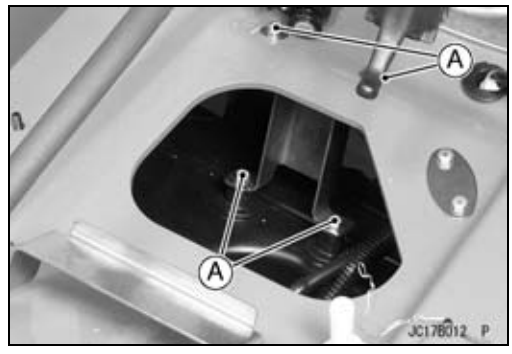
- Remove the engine (see Engine Removal in the Engine Removal/Installation chapter).
- Remove the air box [A] from the engine compartment.



Air Box Installation

- Apply a non-permanent locking agent to the air box bracket bolts [A] and tighten them.

Torque - Air Box Bracket Bolts: 8.8 N·m (0.90 kgf·m, 69 in·lb)

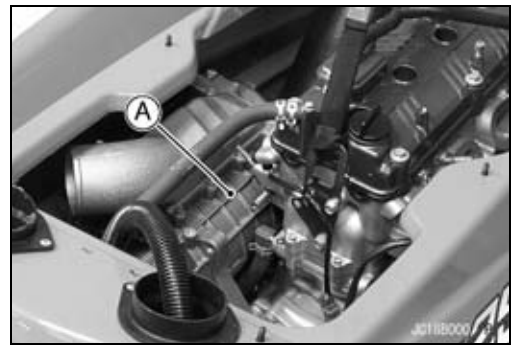


Supercharger

Supercharger Removal

- Refer to Engine Removal in the Engine Removal/Installation chapter.

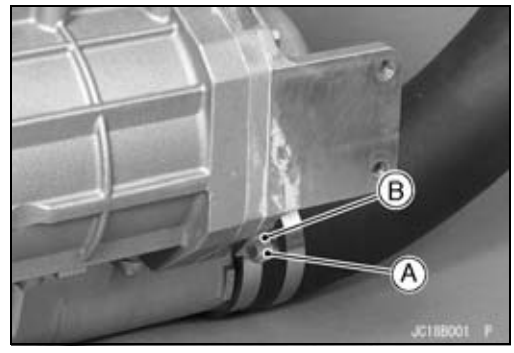
○Remove the exhaust manifold and then remove the supercharger [A] from the engine compartment.



- If necessary, remove the gear oil drain bolt [A] to drain the gear oil.

Supercharger Gear Oil:
Syntheso HT68 (NOK Kruber Brand)

- When installing the drain bolt, replace the gasket [B] with a new one.



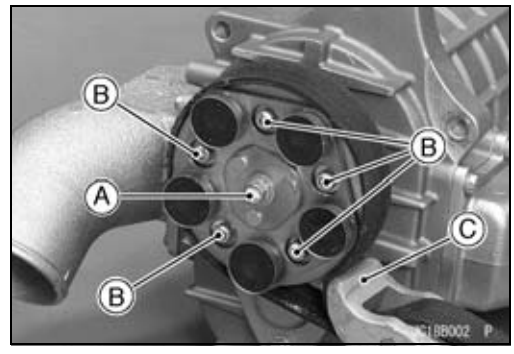
Supercharger Installation

- Refer to Engine Installation in the Engine Removal/Installation chapter.

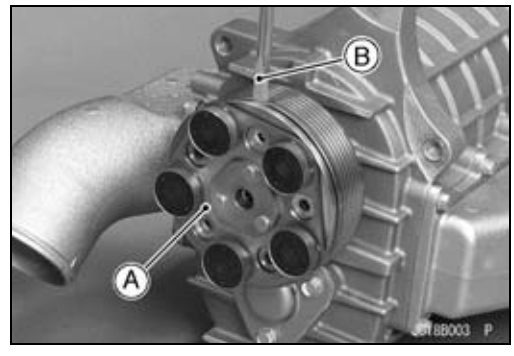
○Install the supercharger and then install the exhaust manifold.

Supercharger Disassembly

- Remove the supercharger (see Supercharger Removal).
- Remove the pulley bolt [A] and pulley plate bolts [B], holding the pulley with a rotor holder [C] (commercial available tool).

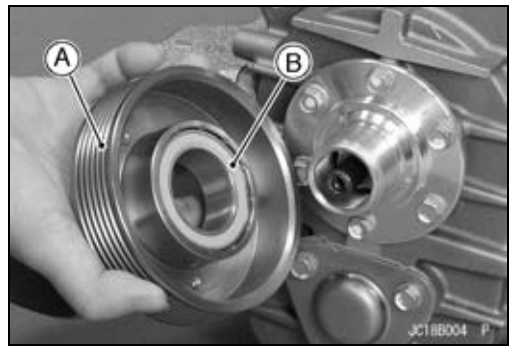


- Remove the pulley plate [A] with a minus driver [B].

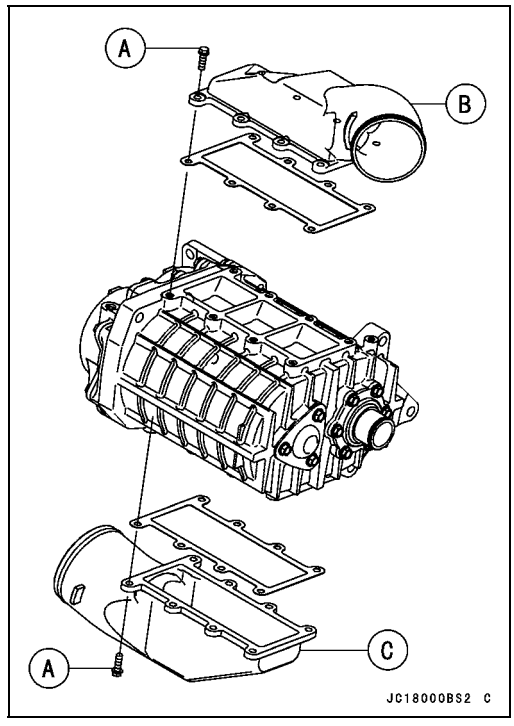


Supercharger

- Remove the circlip.
- Remove the pulley [A] with the bearing [B].



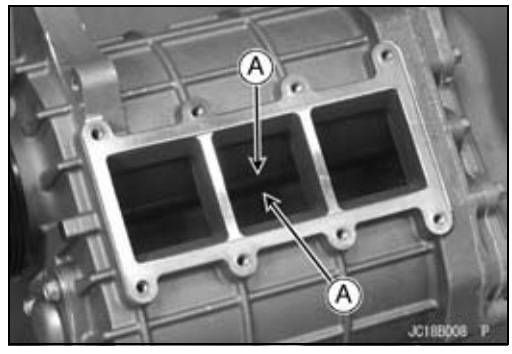
- Unscrew the intake pipe bolts [A], remove the upper [B] and lower [C] intake pipe.



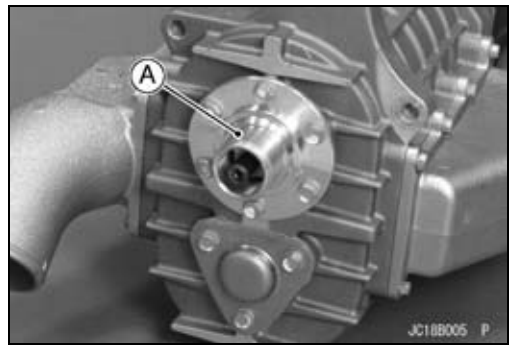
Supercharger Assembly

- Check that salt deposit is on the rotors [A].
- Clean the rotors with cloth and blow the air, turning slowly the pulley.

★If necessary, replace the supercharger assembly.



- Clean the surface of pulley nose [A].



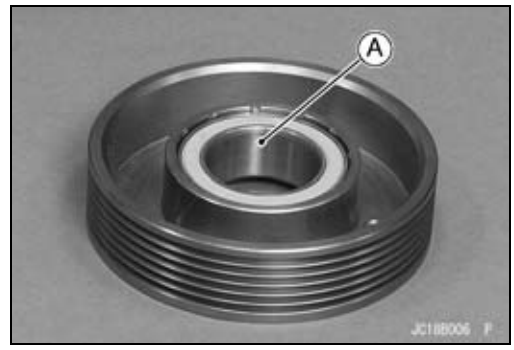
Supercharger

- Spin the bearing [A] by hand to check its condition.

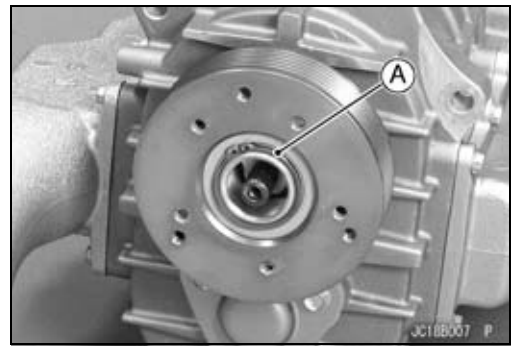
★If it is noisy, does not spin smoothly, or has any rough spots, replace the pulley assy.

- Confirm whether the bearing absorbs water or salt water.

★If it absorbs water or salt water, replace the pulley assy.

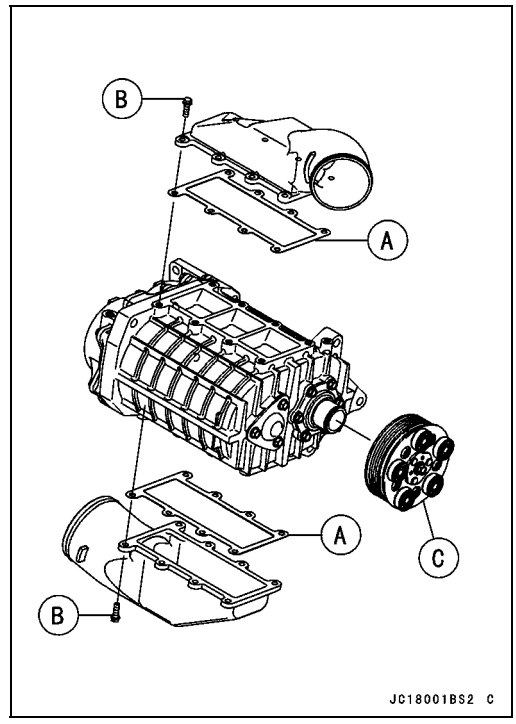


- Replace the circlip [A].



- Apply a non-permanent locking agent to the pulley plate bolts.
- Replace the gasket [A] with a new one.

Torque - Intake Pipe Bolts (IN/OUT) [B]: 7.8 N·m (0.80 kgf·m, 69 in·lb)
Pulley Bolt [C]: 19 N·m (1.9 kgf·m, 14 ft·lb)
Pulley Plate Bolts: 15 N·m (1.5 kgf·m, 11 ft·lb)



Throttle Body Assy

Idle Speed Inspection

The normal idle speed is controlled by the ECU (Electronic Control Unit).

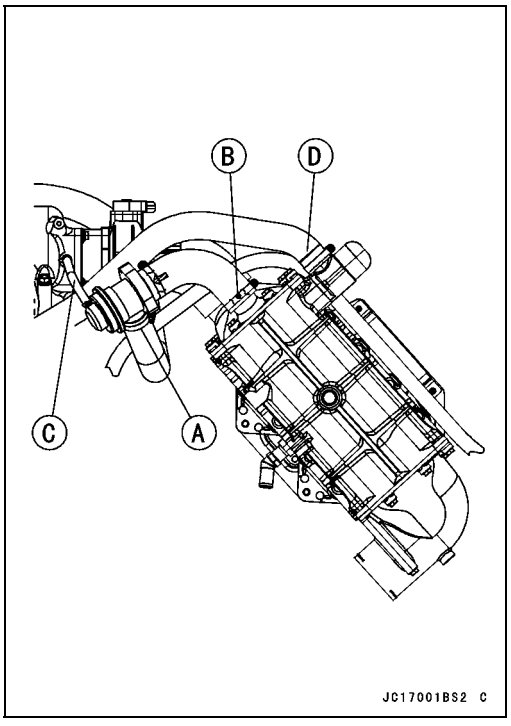
Idle Speed
Standard: 1 300 ±100 r/min (rpm) -both in and out of water

High Altitude Performance Adjustment

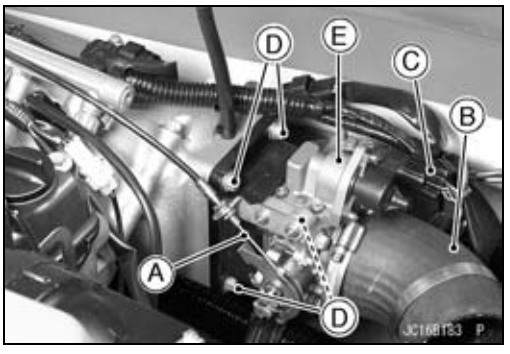
High altitude adjustment is not required as the ECU controls the air/fuel mixture automatically.

Throttle Body Assy Removal

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
- Disconnect:
  Duct [A] (Relief Valve ~ Air Box)
  Tube [B] (Intercooler ~ Relief Valve)
  Pulse Hose [C]
  Duct [D] (Blow off Valve ~ Air Box)



- Remove:
  Throttle Cable [A] (see Throttle Cable Removal)
  Air Inlet Duct [B]
  ISC (Idle Speed Controller) Connector [C]
  Throttle Sensor Connector
  Throttle Body Assy Mounting Bolts [D]
  Throttle Body Assy [E]
  Gasket



Throttle Body Assy Installation

- Install a new gasket.
- Tighten:

Torque - Throttle Body Assy Mounting Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)

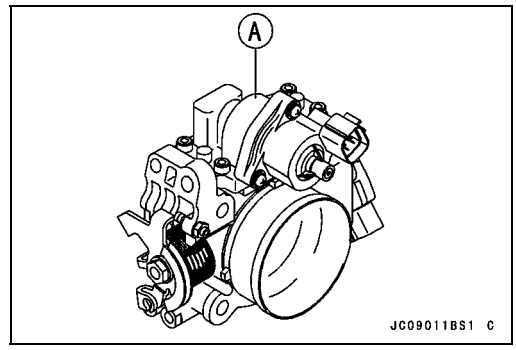
- Install the throttle cable and adjust the free play.
- Route the harness and tighten the band correctly (see Appendix chapter).

Throttle Body Assy

Throttle Body Assy Disassembly

CAUTION

Do not disassemble or adjust, the air screw, throttle link mechanism and throttle body assy [A], because they are adjusted or set surely at the manufacturer. Adjustment of these parts could result in poor performance, requiring replacement of the throttle body assy.



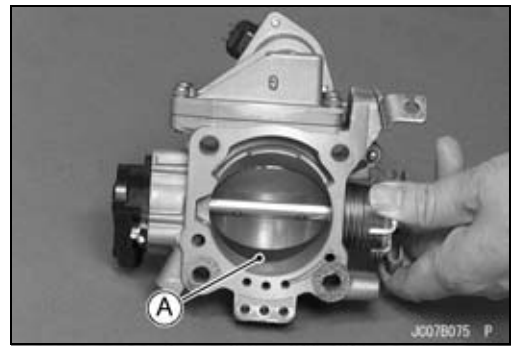
Throttle Bore Cleaning

- Remove the throttle body assy (see Throttle Body Assy Removal).
- Check the throttle bore [A] for carbon deposits by opening the valve.

★If any carbon accumulates, wipe the carbon off the throttle bore and throttle valve, using a cotton pad.

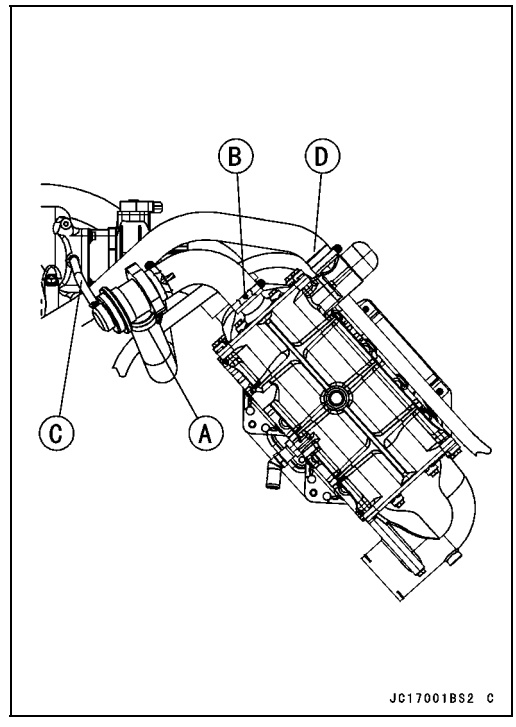
CAUTION

Do not rub these surfaces hard and do not use a carburetor cleaning solution.

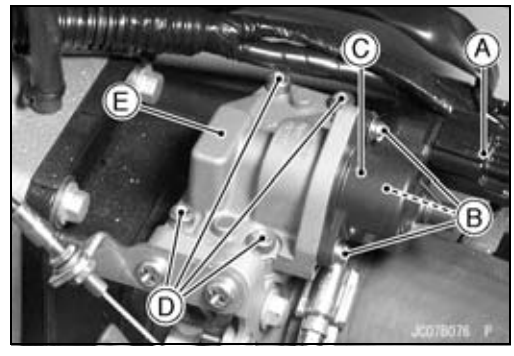


ISC (Idle Speed Controller) Removal

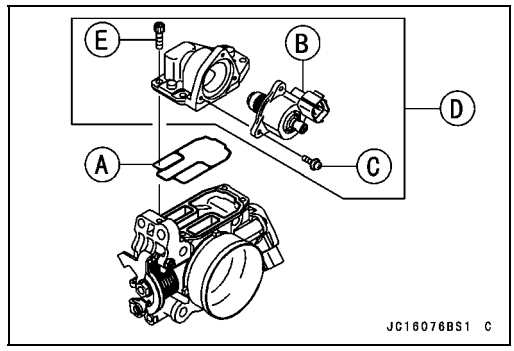
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
- Disconnect:
  Duct [A] (Relief Valve ~ Air Box)
  Tube [B] (Intercooler ~ Relief Valve)
  Pulse Hose [C]
  Duct [D] (Blow off Valve ~ Air Box)



- Remove:
  ISC Connector [A]
  Stepping Motor Mounting Screws [B]
  Stepping Motor [C]
  ISC Actuator Mounting Bolts [D]
  ISC Actuator [E]



Throttle Body Assy



- Clean the mating surface of throttle body and ISC actuator (stepping motor).
- Replace the O-ring [A] with a new one.
- Install the stepping motor [B] and tighten the screws [C].
- Install the ISC actuator [D] and tighten the bolts [E].

Torque - ISC Actuator Mounting Bolts: 4.9 N·m (0.50 kgf·m, 43 in·lb)

- Route the harness and tighten the bands correctly (see Appendix chapter).
- After installing the ISC actuator, check the Smart Steering System Operation in the water.

ISC (Idle Speed Controller) Inspection

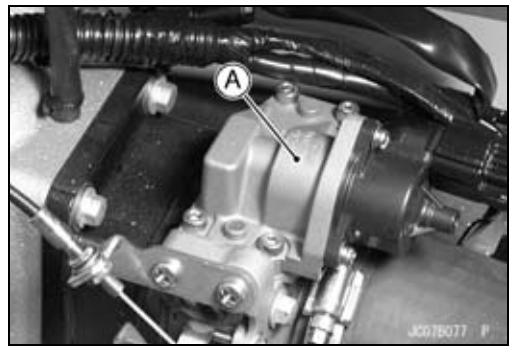
- Check idle speed with a tachometer in the multifunction meter.

○With the engine idling, open and close the throttle lever.

Idle Speed
Standard: 1 300 ±100 r/min (rpm) -both in and out of water

★If the idle speed is within the standard, the ISC operates properly.

★If the idle speed is out of the specified range, inspect the audible operation.



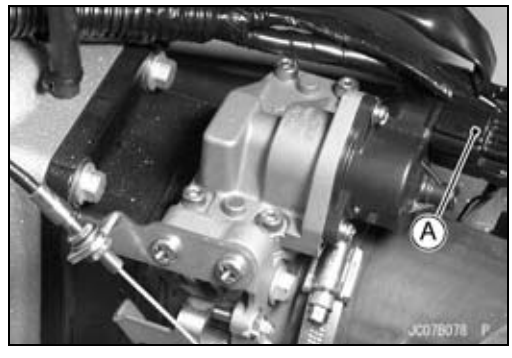
- Run the engine and then stop the engine.
- Certain buzzing and humming sounds will be emitted from the ISC [A] after the engine stop.

★If the ISC sounds, inspect the ISC resistance.

★If the ISC does not sound, replace the steeping motor.

ISC Resistance Inspection

- Remove:
  Air Filter (from the throttle body assy)
  ISC Connector [A] (disconnect)



Throttle Body Assy

● Measure the ISC resistance with the hand tester.

Special Tool - Kawasaki Hand Tester: 57001-1394

ISC [A]
Rotor [B]

ISC Resistance

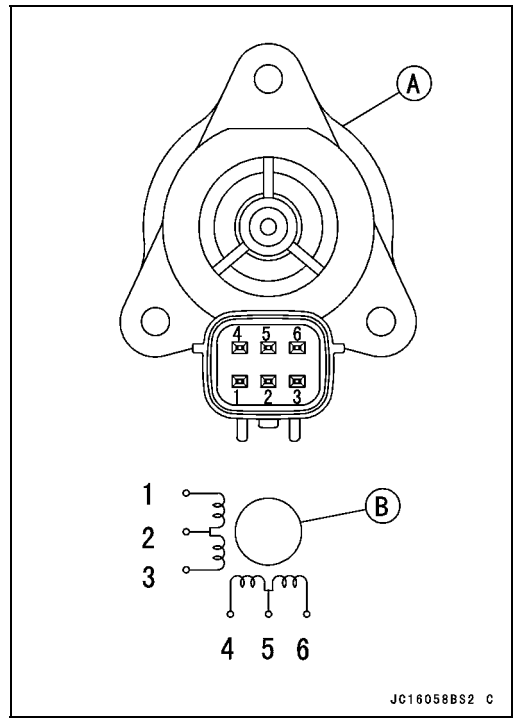
Connection: 1-2, 2-3, 4-5, 5-6 terminals

Standard: about 30 Ω (at 20°C)

Connection: 1-3, 4-6 terminals

Standard: about 60 Ω (at 20°C)

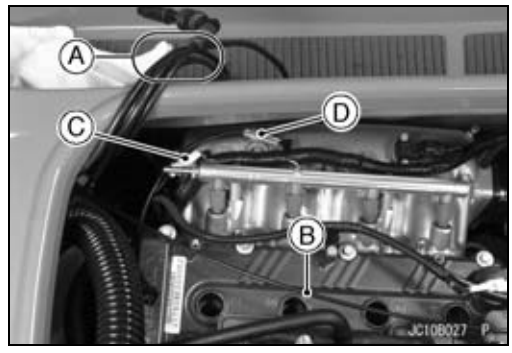
★If the reading is out of the specified value, replace the steeping motor.



Inlet Manifold

Inlet Manifold Removal

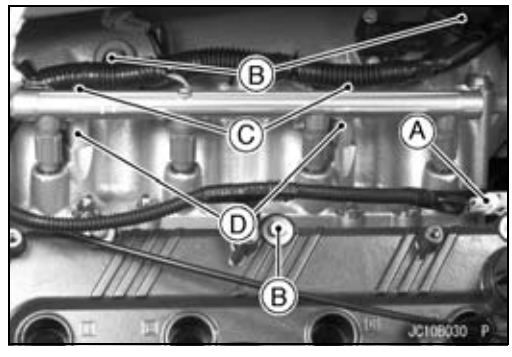
- Remove the intercooler (see Engine Removal i the Engine Removal/Installation chapter).
- Remove the spark plug leads and place them [A] out of the engine compartment.
- Disconnect the fuel hose form the delivery pipe (see Fuel Hose Removal).
- Disconnect the throttle cable [B] end from the throttle body.
- Disconnect:
  ISC Connector
  Throttle Sensor Connector
  Oil Temperature Sensor Connector [C]
  Crankshaft Sensor Connector [D]



- Disconnect:
  Inlet Air Temperature Sensor Connector [A]
  Inlet Air Pressure Sensor Connector

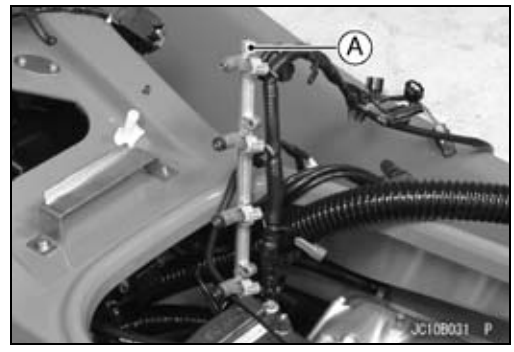
- Disconnect:
  Speed Sensor Connector [A]
  Camshaft Position Sensor Connector

- Disconnect the water temperature sensor connector [A].
- Remove the harness bolts [B].
- Remove:
  Delivery Pipe Mounting Bolts [C] and Collars [D]

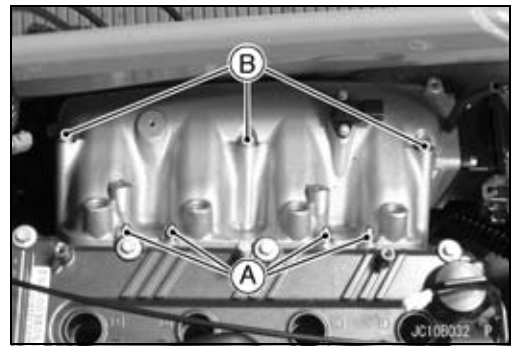


Inlet Manifold

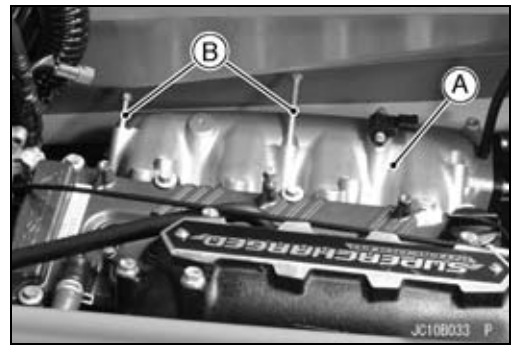
- Place the delivery pipe with the harness [A] out of the engine compartment as shown.



- Unscrew the inlet manifold mounting bolts [A] and nuts [B].



- Remove the inlet manifold [A] with two bolts [B] indicated in the figure.



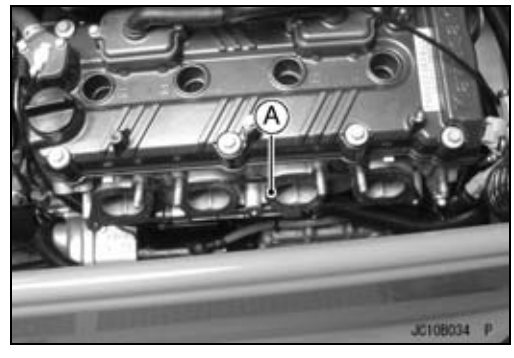
Inlet Manifold Installation

- Replace the inlet manifold gasket with a new one.
- Tighten:

Torque - Inlet Manifold Drain Plug: 20 N·m (2.0 kgf·m, 14 ft·lb)
Inlet Air Temperature Sensor: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Replace the inlet manifold gasket [A] with a new one and install it as shown.

Torque - Inlet Manifold Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)
Inlet Manifold Mounting Nuts: 20 N·m (2.0 kgf·m, 14 ft·lb)

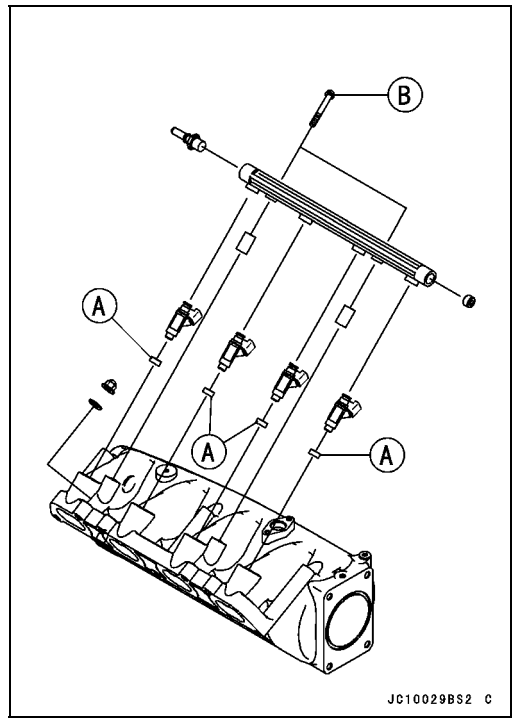


Inlet Manifold

- Replace the injector seals [A] with new ones.
- Apply grease to the inside and outside of seals.
- Tighten the delivery pipe mounting bolts [B].

Torque - Delivery Pipe Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

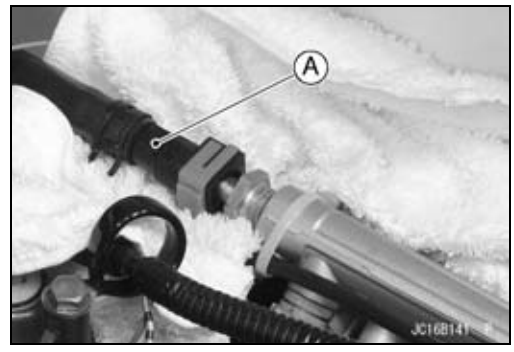
- Install the fuel hose (see Fuel Hose Installation).
- Route the cable, wire and hose correctly (see Cable, Wire and Hose Routing in Appendix chapter).



Fuel Line

Fuel Hose Removal

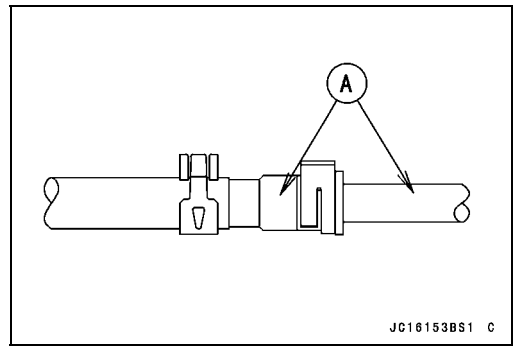
- Be sure to place a piece of cloth under the fuel supply hose [A] of the fuel delivery pipe.



⚠ WARNING

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.
When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

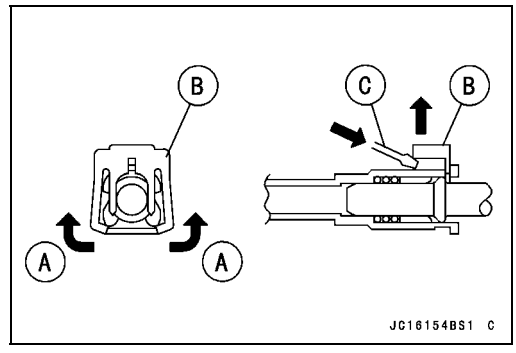
- Wipe off the dirt of the surface [A] around the connection using a cloth or a soft brush.



- Open and push up [A] the joint lock [B] with your fingers or flat-blade screwdriver [C].

CAUTION

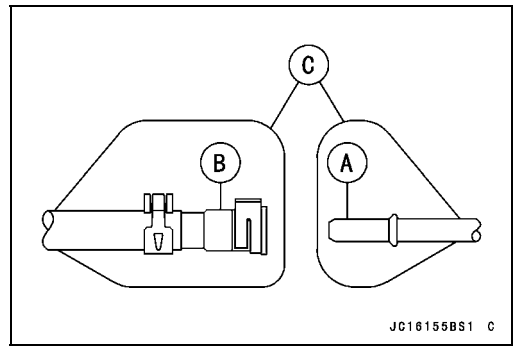
The joint lock has a retaining edge that locks around the housing. Do not pry or excessively widen the joint lock ends for fuel hose removal, it will permanently deform the joint lock, resulting in a loose or incomplete lock.



- Remove the fuel hose.
- Cover the pipe [A] and the hose joint [B] with the vinyl bags [C] to avoid becoming dirty.

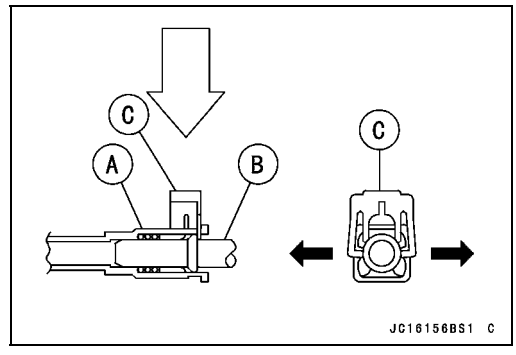
NOTE

○*Do not attempt to check the joint lock with fuel hose removed from the pipe. It will not lock into position unless the hose is attached to the pipe.*



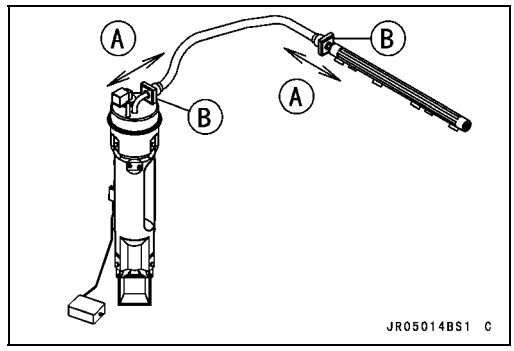
Fuel Hose Installation

- Insert the hose joint [A] securely onto the pipe [B], and push down the joint lock [C].

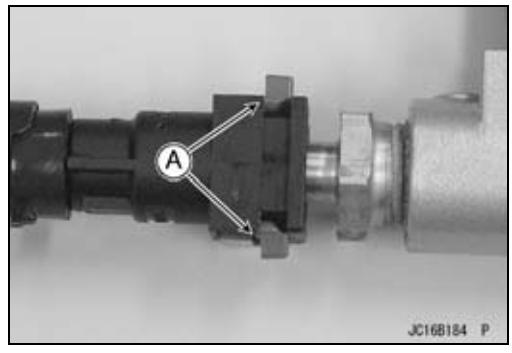


Fuel Line

● Push and pull [A] the hose joints [B] back and forth more than two times and make sure they are locked and don't come off. When the hose joints are correctly installed, they should slide on the pipe about 1 ~ 2 mm (0.04 ~ 0.08 in.).



● Check the joint lock for deformation and wear.
★If the joint lock is deformed [A], replace the fuel hose with a new one.



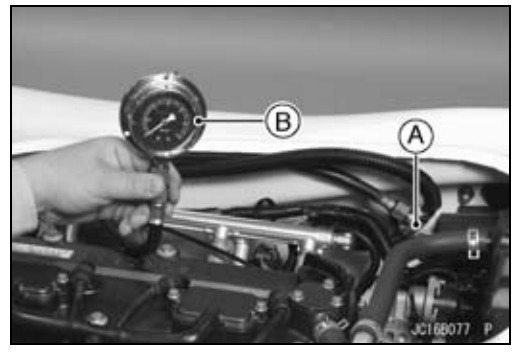
Fuel Pressure Inspection

NOTE

○*Be sure the battery is fully charged.*

● Disconnect the fuel hose from the delivery pipe and fuel pump pipe (see Fuel Hose Removal).

Fuel Line



- Quickly install the fuel pressure gauge adapter [A] between the fuel supply pipe and the fuel supply hose.
- Connect the pressure gauge [B] to the fuel pressure gauge adapter.

Special Tools - Oil Pressure Gauge, 5 kgf/cm²: 57001-125
Fuel Pressure Gauge Adapter: 57001-1593
Fuel Hose: 57001-1607

⚠ WARNING

Do not try to start the engine with the fuel hoses disconnected.

- Start the engine, and let it idle.
- Measure the fuel pressure with the engine idling.

Fuel Pressure (idling)

Standard: approx. 294 kPa (3.0 kgf/cm², 43 psi)

NOTE

○*The gauge needle will fluctuate. Read the pressure at the average of the maximum and minimum indications.*

★If the fuel pressure is much higher than the specified, check the following:
Fuel Hose from Gauge Adapter to Fuel Pump Return Pipe for Sharp Bend, Kinking, or Clogging
Fuel Pump

★If the fuel pressure is much lower than specified, check the following:
Fuel Line Leakage
Fuel Injectors
Fuel Pump
Amount of Fuel Flow (see Fuel Flow Rate Inspection)

★If the fuel pressure is much lower than specified, and if inspection above checks out good, replace the fuel filter and measure the fuel pressure again.

- Remove the fuel pressure gauge and adapter.
- Run the fuel hoses in accordance with the Cable, Wire, and Hose Routing section in the Appendix chapter.

Fuel Flow Rate Inspection

NOTE

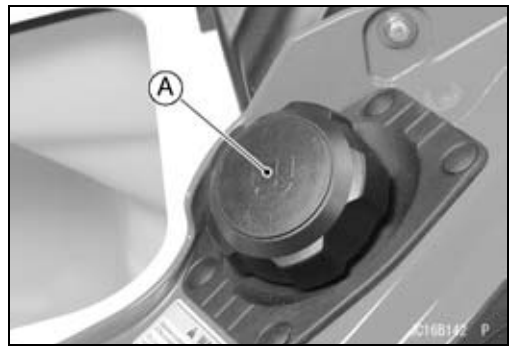
○*Be sure the battery is fully charged.*

⚠ WARNING

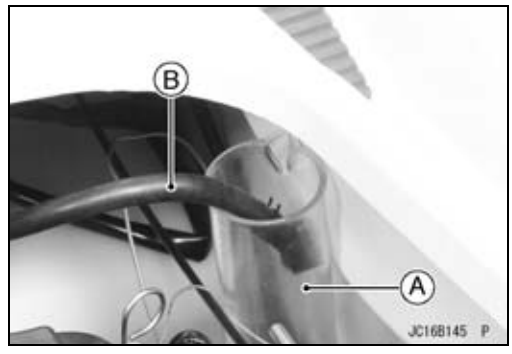
Gasoline is extremely flammable and can be explosive under certain conditions. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

Fuel Line

- Turn the ignition switch OFF.
- Wait until the engine cools down.
- Open the fuel tank cap [A] to lower the pressure in the tank.



- Prepare a measuring cylinder [B].
- Disconnect the fuel supply hose from the fuel delivery pipe (see Fuel Hose Removal).
- Set the measuring cylinder and fuel supply hose [A] as shown.
- Close the fuel tank cap.



⚠ WARNING

Wipe off spilled out fuel immediately.
Be sure to hold the measuring cylinder vertical.

- Turn the ignition switch ON.
- Push the start button for 3 seconds.
- Measure the discharge for 3 seconds.

Amount of Fuel Flow
Standard: 83 mL or more for 3 seconds

★If the fuel flow is much less than the specified, check the following:
Fuel Hose from Fuel Pump Supply Pipe to Fuel Filter for Sharp Bend, Kinking, or Clogging
Fuel Pump Operation (see Fuel Pump Operation Inspection)
Fuel Pump Screen (see Fuel Pump Screen Cleaning)

★If above inspection checks out good, replace the fuel pump, and measure the amount of fuel flow again.

- After inspection, connect the fuel hose.
- Start the engine and check for fuel leakage.

Fuel Vent Check Valve

Fuel Vent Check Valve Mounting

- Refer to Fuel Vent Check Valve Inspection in the Periodic Maintenance chapter.

Fuel Vent Check Valve Inspection

- Refer to Fuel Vent Check Valve Inspection in the Periodic Maintenance chapter.

Fuel Pump

Fuel Pump Removal

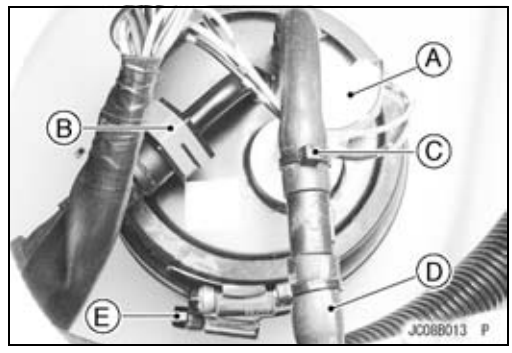
CAUTION

Never drop the fuel pump, especially on a hard surface. Such a shock to the pump can damage it.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke.

- Remove the center access cover (see Steering Cover Removal in the Steering chapter).
- Disconnect the fuel pump lead connector [A].
- Pull the joint lock.
- Pull the fuel hose joint [B] out of the fuel pump pipe (see Fuel Hose Removal).

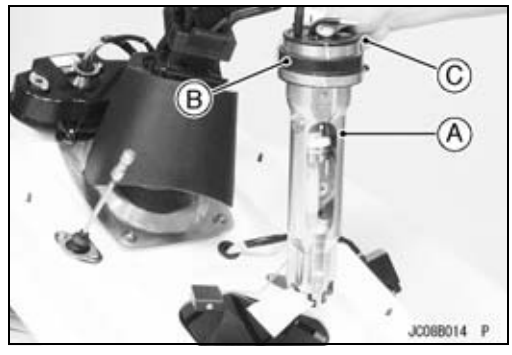


⚠ WARNING

Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.
When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

- Cut off the clamp [C] and pull out the fuel vent hose [D].
- Loosen the lower side clamp screw [E] on the rubber fuel pump holder.

- Pull the fuel pump [A] and rubber holder [B] through the opening gained after removal of the access hole on the deck.
- Loose the upper side clamp screw [C] and remove the rubber holder from the fuel pump.



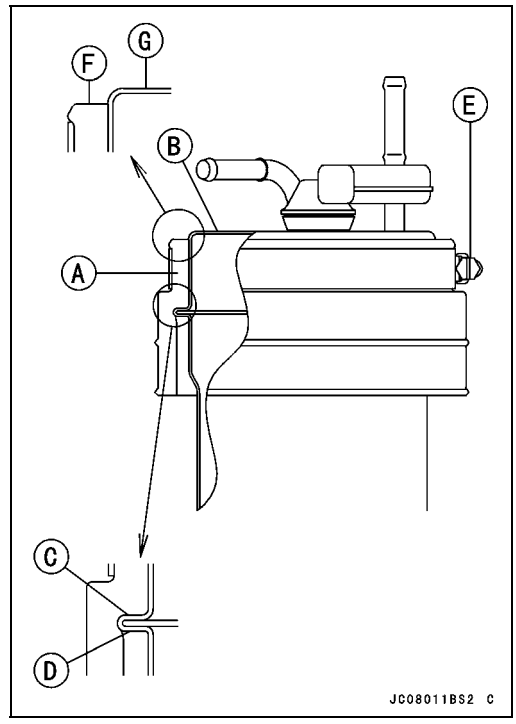
Fuel Pump

Fuel Pump Installation

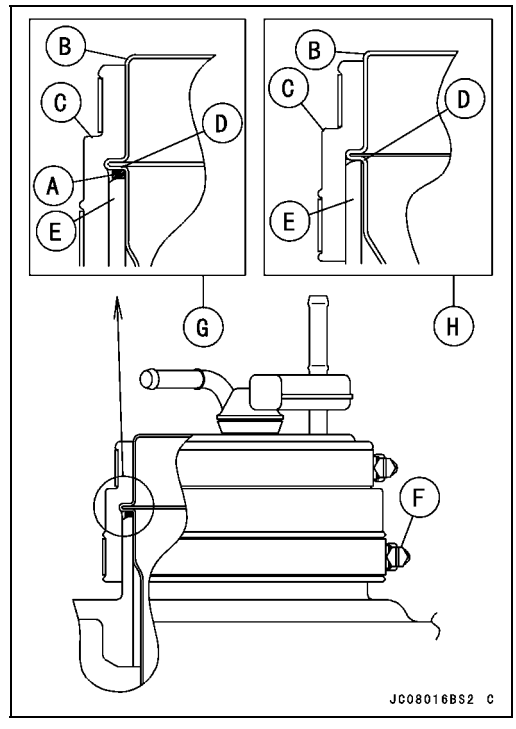
- Press down the rubber holder [A] onto the fuel pump [B] so the stepped part [C] of the holder completely contacts the flanged part [D] of the pump.
- Pressing down the rubber holder onto the fuel pump, tighten the small diameter clamp [E].

NOTE

○*Install the rubber holder onto the fuel pump so the rubber holder top surface [F] must be below the top surface [G] of the fuel pump to prevent any water from collecting on top of the pump.*

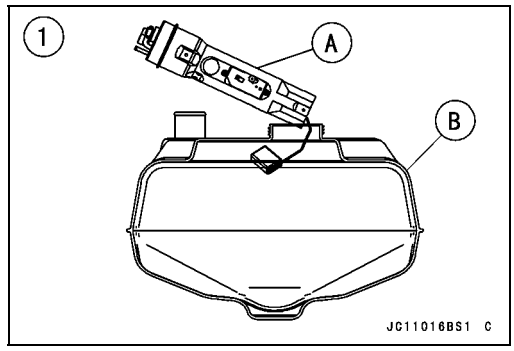


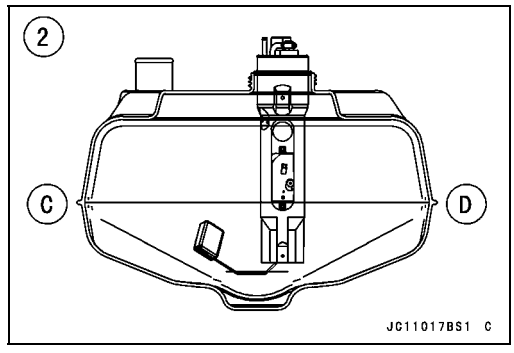
- Install the O-ring [A] to the space between fuel pump [B] and rubber holder [C] so it completely contacts the flanged part [D] of the pump (JT1500B7F model).
- Insert the fuel pump with rubber holder and O-ring into the tank so its fuel hose fittings face starboard side (see Cable, Wire, and Hose Routing in Appendix chapter). And press down the pump so the O-ring [A] completely contacts the top surface of the tank [E] (JT1500B7F model).
- Insert the fuel pump with rubber holder into the tank so its fuel hose fittings face starboard side (see Cable, Wire and Hose Routing section in Appendix chapter). And press down the pump so that the fuel pump completely contacts the top surface of the tank [E] (JT1500B8F model).
- Tighten the large diameter clamp [F] securely.
  JT1500B7F Model [G]
  JT1500B8F Model [H]

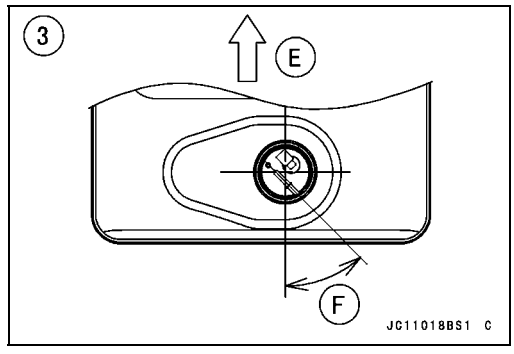


Fuel Pump

● Install the fuel pump [A] in the fuel tank [B].
L/H [C]
R/H [D]
BOW [E]
45° [F]





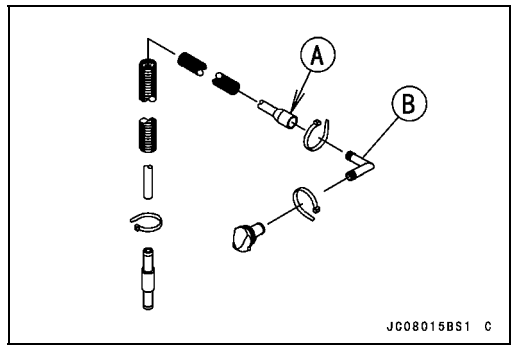


● Install the following to the fuel pump.
Fuel Hose (see Fuel Hose Installation)
Fuel Tank Vent Hose
Fuel Pump Lead Connector

○Install the vent hose so that the large side [A] of the hose fits the joint [B] (F/No. US-KAW35538D707 ~).

NOTE

○*The main fuel hose is larger than the return fuel hose.*

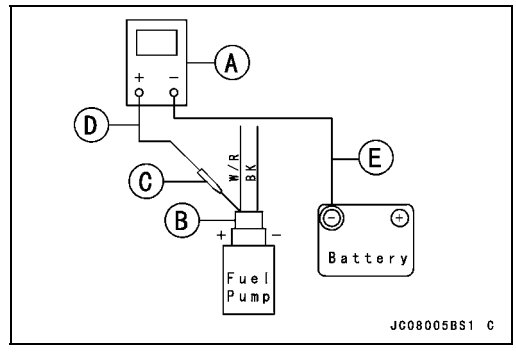


Power Source Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*

Fuel Pump



- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Connect the hand tester (25 V DC) [A] to the fuel pump lead connector [B], using the needle adapter set [C].

Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the power source voltage.

○Wait 15 seconds before using the starter again.

Pump Power Source Voltage
Connections
Tester (+) → W/R lead [D]
Tester (–) → Battery (–) Terminal [E]

Power Source Voltage at Pump Lead Connector
Standard: Battery Voltage

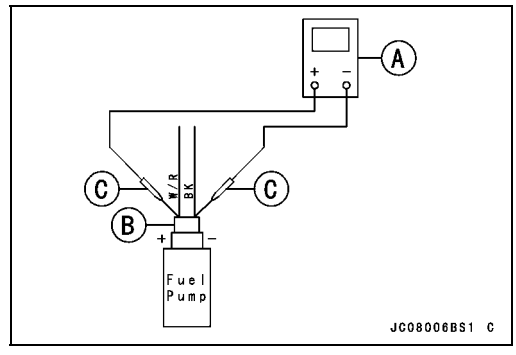
★If the reading is good, the power source voltage is normal. Inspect the operating voltage.

★If there is no battery voltage, check the following:
Main Fuse 20 A
Wiring for Fuel Pump Power Source (see Fuel Pump Circuit in this chapter)

Operating Voltage Inspection

NOTE

○*Be sure the battery is fully charged.*



- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Connect the hand tester [A] to the connector [B], using the needle adapter set [C].

Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the operating voltage.

○Wait 15 seconds before using the starter again.

Pump Operating Voltage
Connections
Tester (+) → W/R lead
Tester (–) → BK lead
Operating Voltage
Standard: Battery Voltage

★If the reading stays on battery voltage but the pump doesn't work, replace the pump.

★If there is no battery voltage at all, check the ECU for its ground and power supply (see ECU Power Supply Inspection).

★If the ground and power supply are good, check the fuel pump wiring.

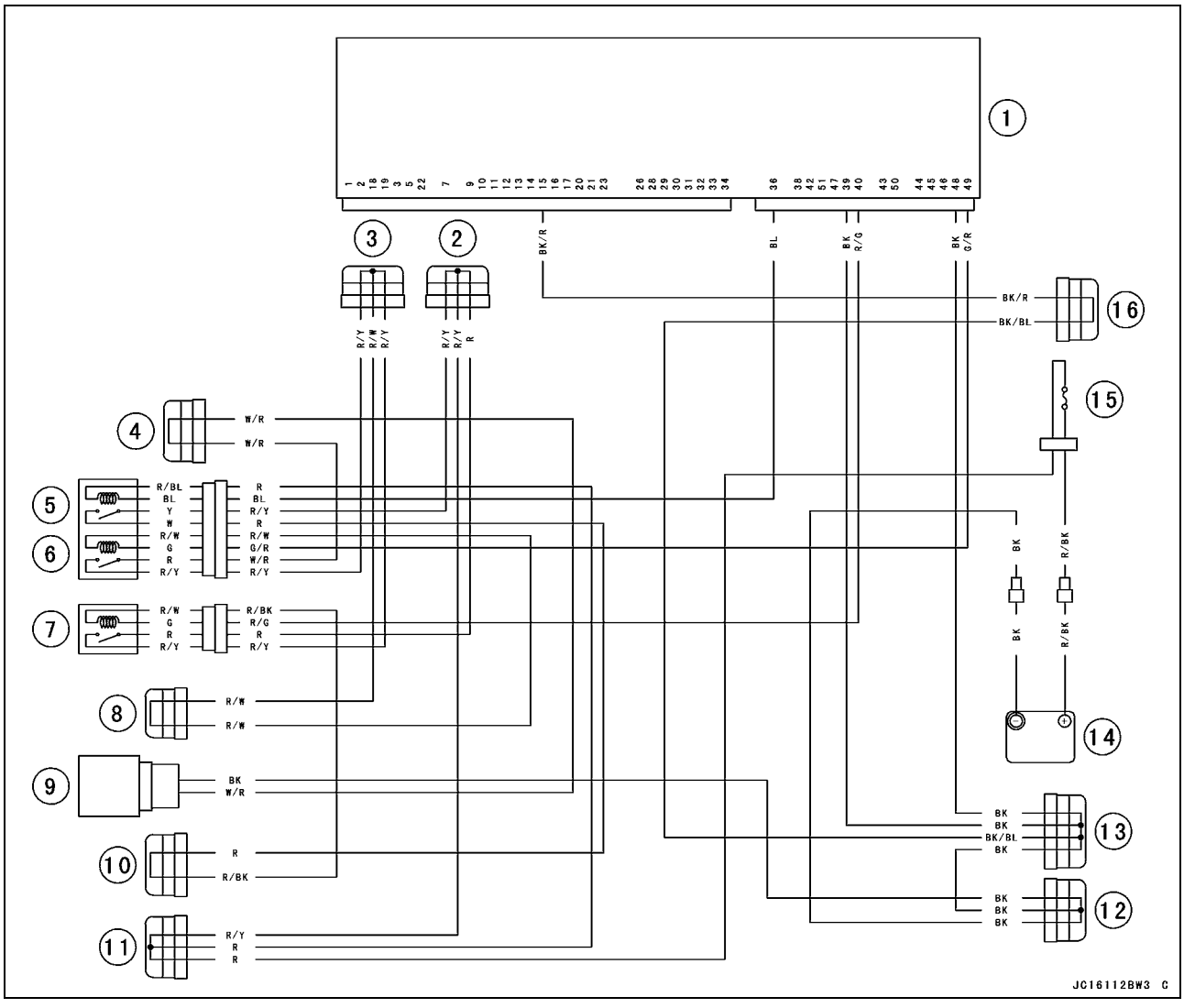
Fuel Pump

Fuel Pump Relay Removal

- Refer to the Relay Assembly Removal in the DFI Power Source section.

Fuel Pump Relay Inspection

- Refer to the Relay Assembly Inspection in the DFI Power Source section.



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. Joint Connector 4 (Power (12V) - Injector)
5. System Relay
6. Fuel Pump Relay
7. Main (ECU) Relay
8. Joint Connector 3 (Switch (12V))
9. Fuel Pump
10. Joint Connector 2
11. Joint Connector 1
12. Joint Connector 12 (Ground)
13. Joint Connector 11 (Ground)
14. Battery
15. Main Fuse 20A
16. Joint Connector 9 (Ground Cntrol)

Fuel Tank

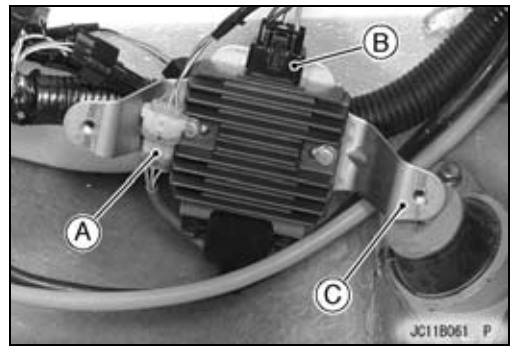
Fuel Tank Removal

- Drain the fuel tank into a suitable container.

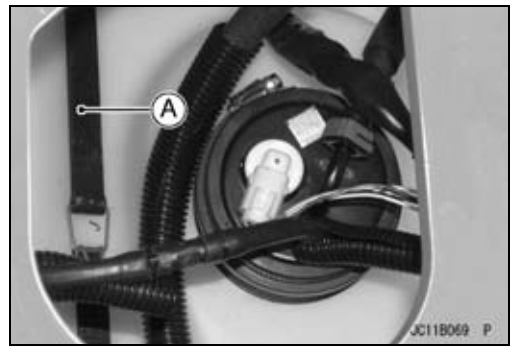
⚠ WARNING

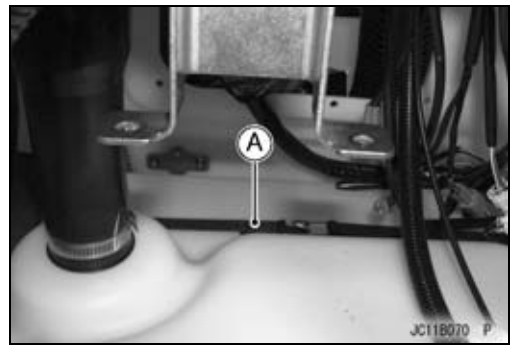
Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- Remove the engine (see Engine Removal in the Engine Removal/Installation chapter).
- Disconnect the following from the main harness.
  Vehicle-down Sensor Lead Connector [A]
  Ignition Coil Lead Connectors
  Regulator/rectifier Lead Connector [B]
- Remove the bracket [C] out of the engine compartment.



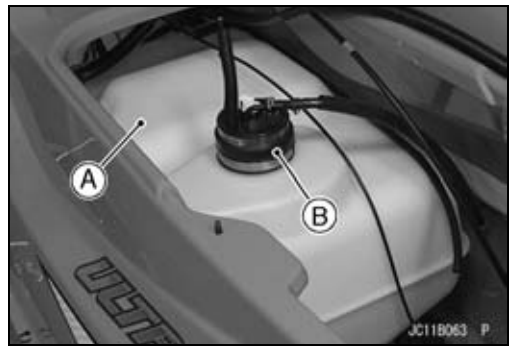
- Remove the fuel filler tube from the fuel tank.
- Unhook the fuel tank straps [A].

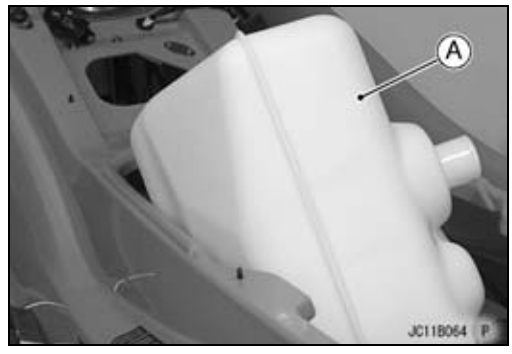




Fuel Tank

● Remove the fuel tank [A] out of the hull as shown.
○Remove the fuel pump [B] (see Fuel Pump Removal).





Fuel Tank Installation

● Be sure the float [A] in place before putting the fuel tank into the hull.
● Install the fuel hose (see Fuel Hose Installation).
● Route the following correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
Fuel Hoses
Fuel Tank Vent Hose
Other Wire and Harness

Fuel Tank Cleaning

● Remove the fuel tank (see Fuel Tank Removal).
● Drain the tank into a suitable container.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or spark; this includes any appliance with a pilot light.

● Flush the tank repeatedly with high-flash-point solvent until it is clean. It may be necessary to put a few marbles or pieces of clean gravel into the tank and shake it, to knock loose any foreign matter in the bottom.

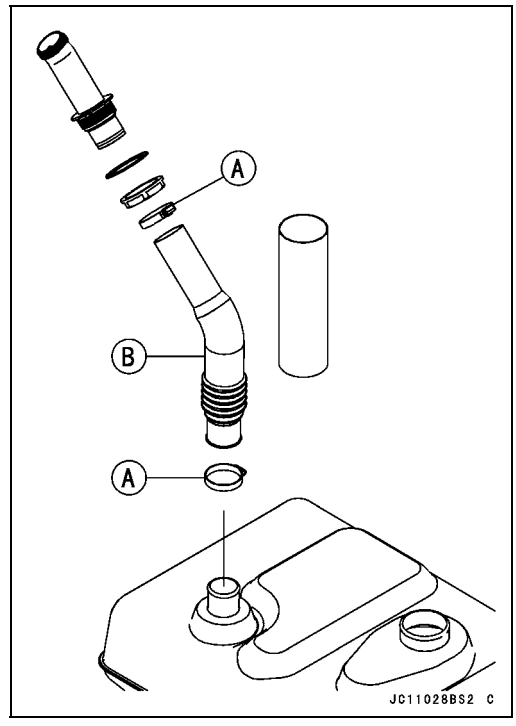
⚠ WARNING

Clean the tank in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the tank. A fire or explosion could result.

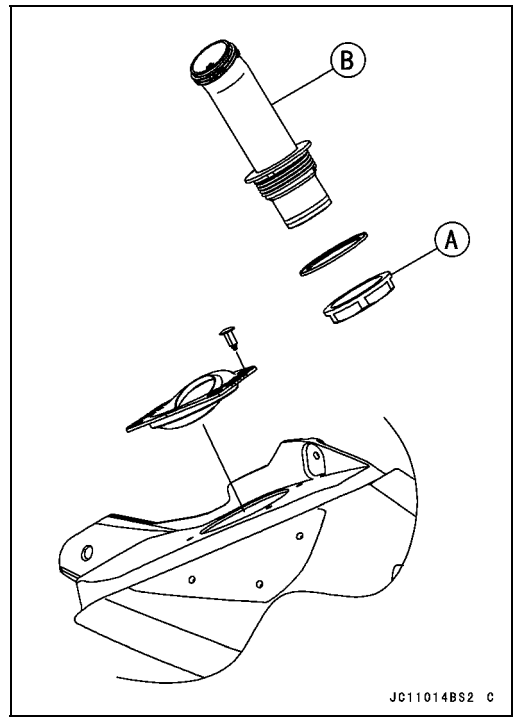
Fuel Tank

Fuel Filler and Tube Removal

- Remove the front access cover (see Front Access Cover Removal/Installation in the Hull/Engine Hood chapter).
- Loosen the fuel filler tube clamp screws [A] and remove the fuel filler tube [B].

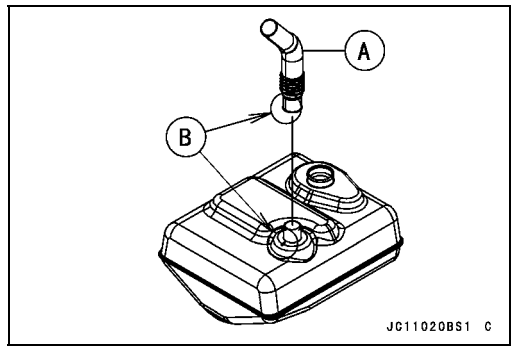


- Remove the left side cover (see Side Cover Removal in the Hull/Engine Hood chapter).
- Take out the nut [A] in the filler flange and remove the fuel filler [B].

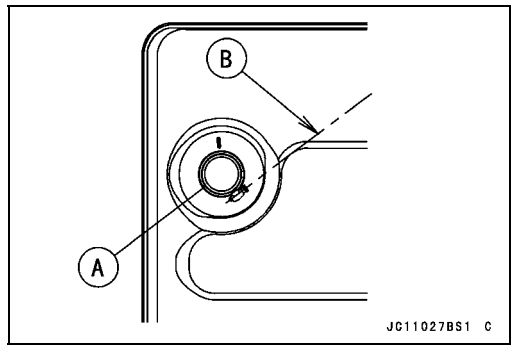


Fuel Tank

● Note the following when installing the tube [A].
○Fit [B] the parting line of tube to mark on the tank.



○Install the lower clamp [A] so that its screw head screw points inclined line [B].



Fuel Filler and Tube Installation

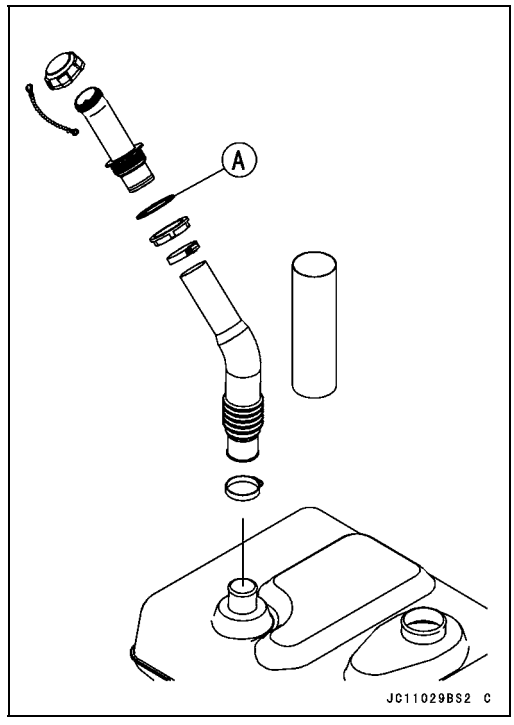
● Clean the deck and filler on their mating surfaces with greaseless, high-flash point solvent.

⚠ WARNING

Clean the parts in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent. A fire or explosion could result.

● Replace the fuel filler gasket [A] with a new one.
● Tighten the fuel filler tube clamp screws.

Torque - Fuel Filler Tube Clamp Screws: 2.9 N·m (0.30 kgf·m, 26 in·lb)



Engine Lubrication System

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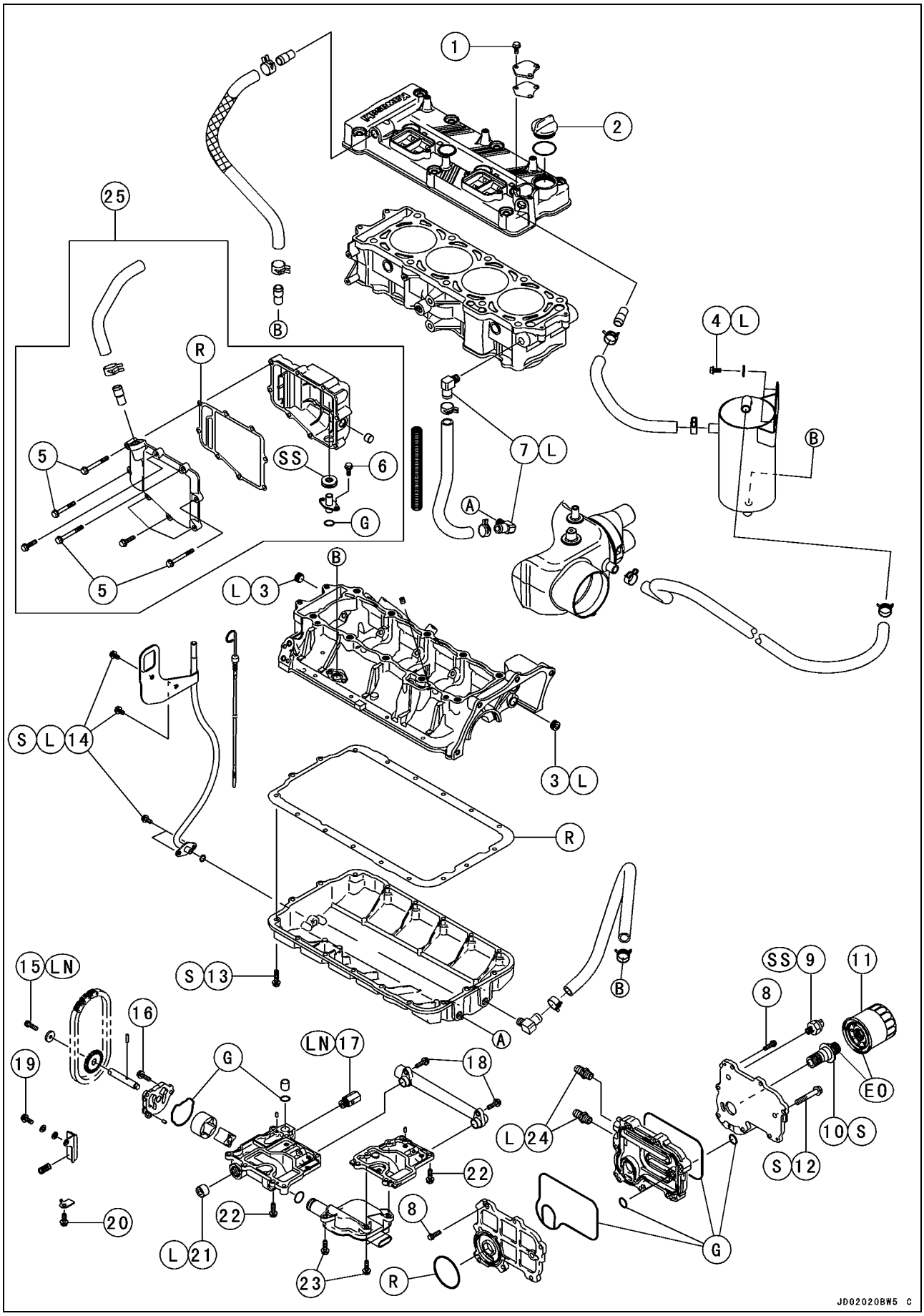
Exploded View



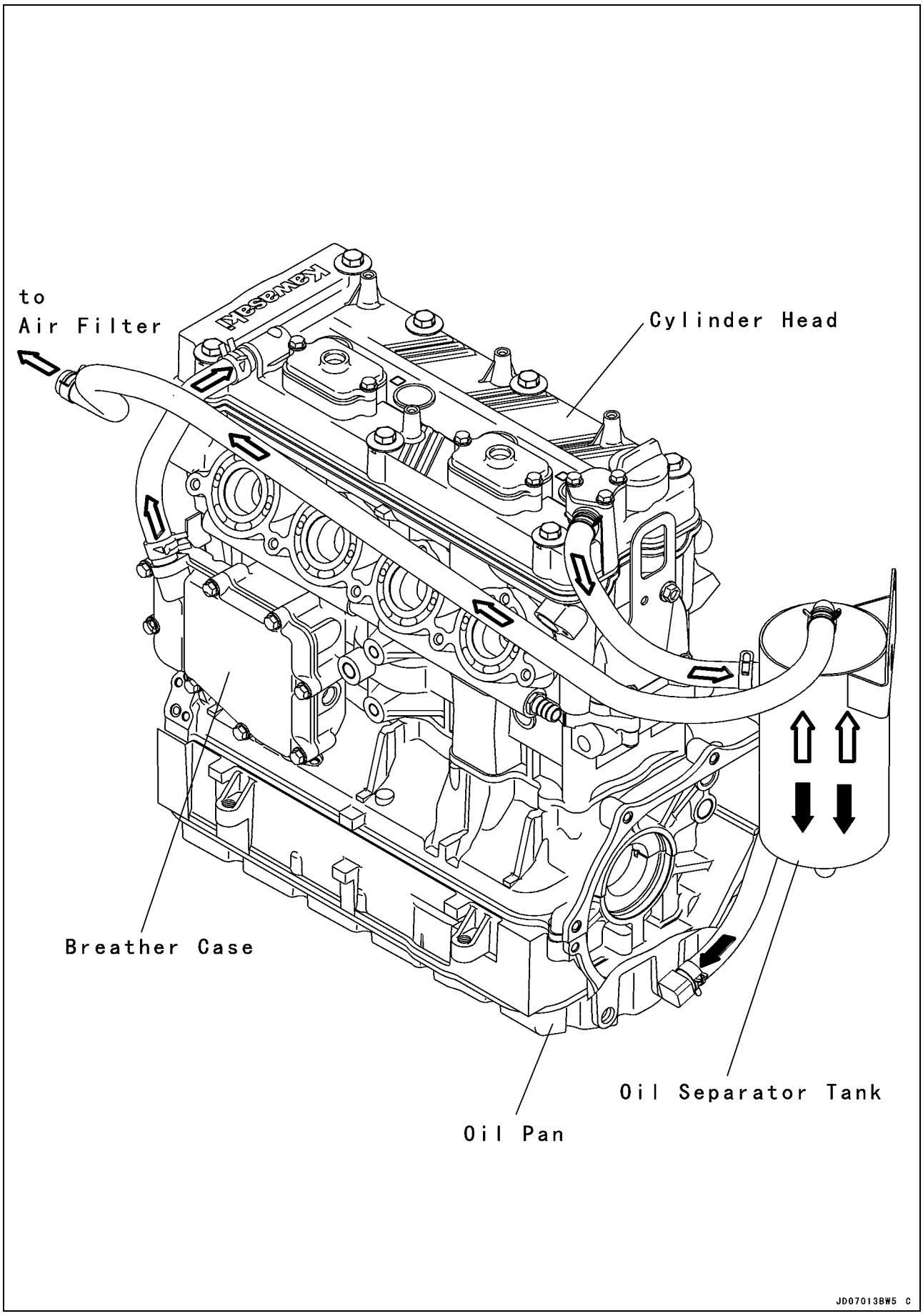
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Breather Plate Bolts	7.8	0.80	69 in·lb	
2	Oil Filler Cap	–	–	–	Hand-tighten
3	Oil Passage Plugs	20	2.0	14	L
4	Oil Separator Tank Mounting Bolts	4.9	0.50	43 in·lb	L
5	Breather Case Mounting Bolts	7.8	0.80	69 in·lb	
6	Breather Pipe Bolts	8.8	0.90	78 in·lb	
7	Oil Passage Joints	11	1.1	95 in·lb	L
8	Oil Cooler Assembly Bolts	7.8	0.80	69 in·lb	
9	Oil Pressure Switch	15	1.5	11	SS
10	Oil Passage Bolt	78	8.0	58	S
11	Oil Filter	18	1.8	13	EO
12	Oil Cooler Positioning Bolt	20	2.0	14	S
13	Oil Pan Bolts	7.8	0.80	69 in·lb	S
14	Dipstick Tube Bolts	7.8	0.80	69 in·lb	L, S
15	Oil Pump Sprocket Bolt	16	1.6	12	LN
16	Oil Pump Cover Bolts	7.8	0.80	69 in·lb	
17	Oil Pressure Relief Valve	15	1.5	11	LN
18	Oil Pipe Bolts	7.8	0.80	69 in·lb	
19	Oil Pump Chain Guide Bolt	7.8	0.80	69 in·lb	
20	Chain Guide Spring Plate Bolt	7.8	0.80	69 in·lb	
21	Oil Pump Body Plug	20	2.0	14	L
22	Oil Pump Body Bolts	7.8	0.80	69 in·lb	
23	Oil Screen Bolts	7.8	0.80	69 in·lb	
24	Water Hose Joints	20	2.0	14	SS

25. JT1500B7F Model
EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).
R: Replacement Parts
S: Follow the specific tightening sequence.
SS: Apply silicone sealant (see text).

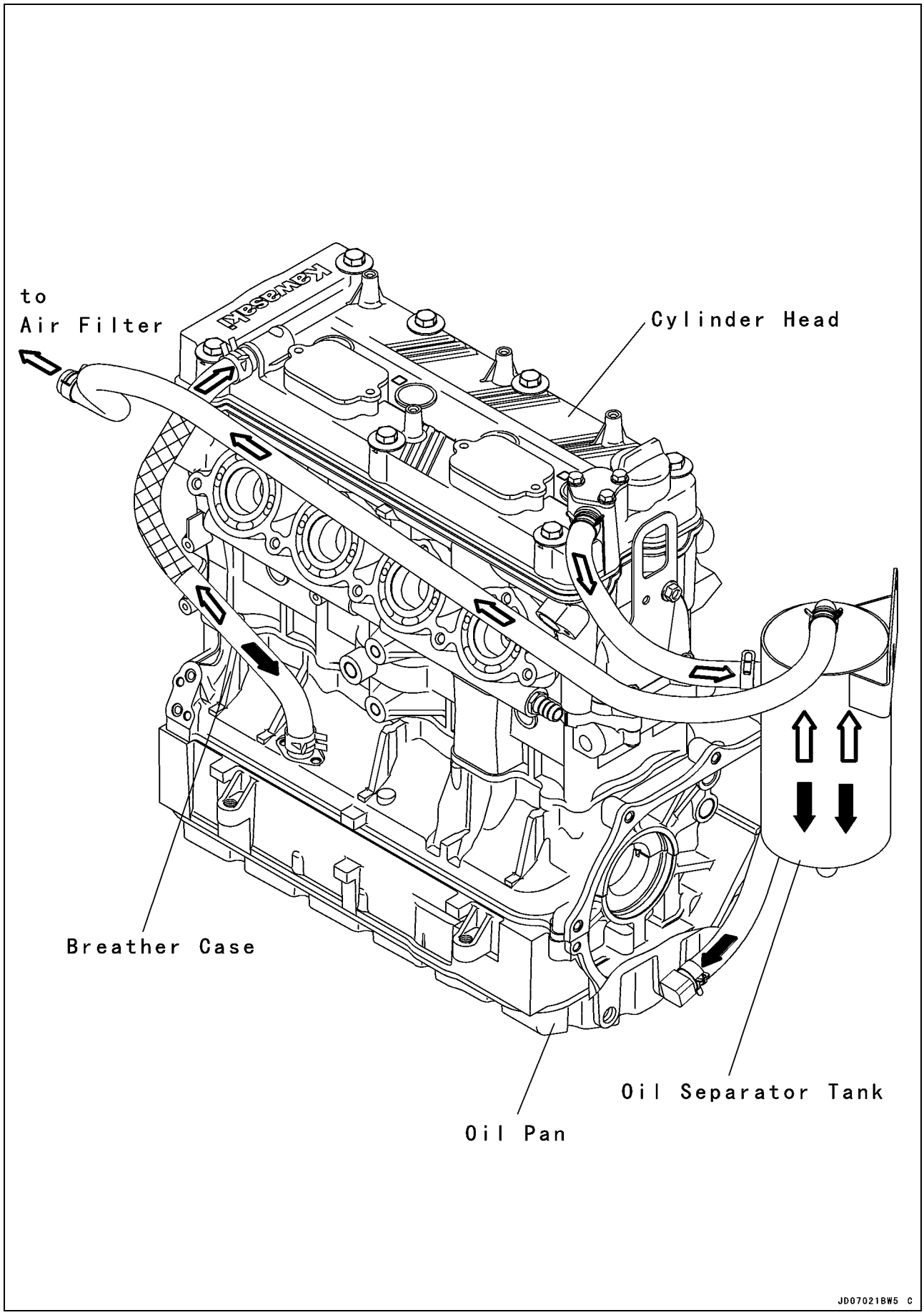
Engine Oil Flow Chart

JT1500B7F

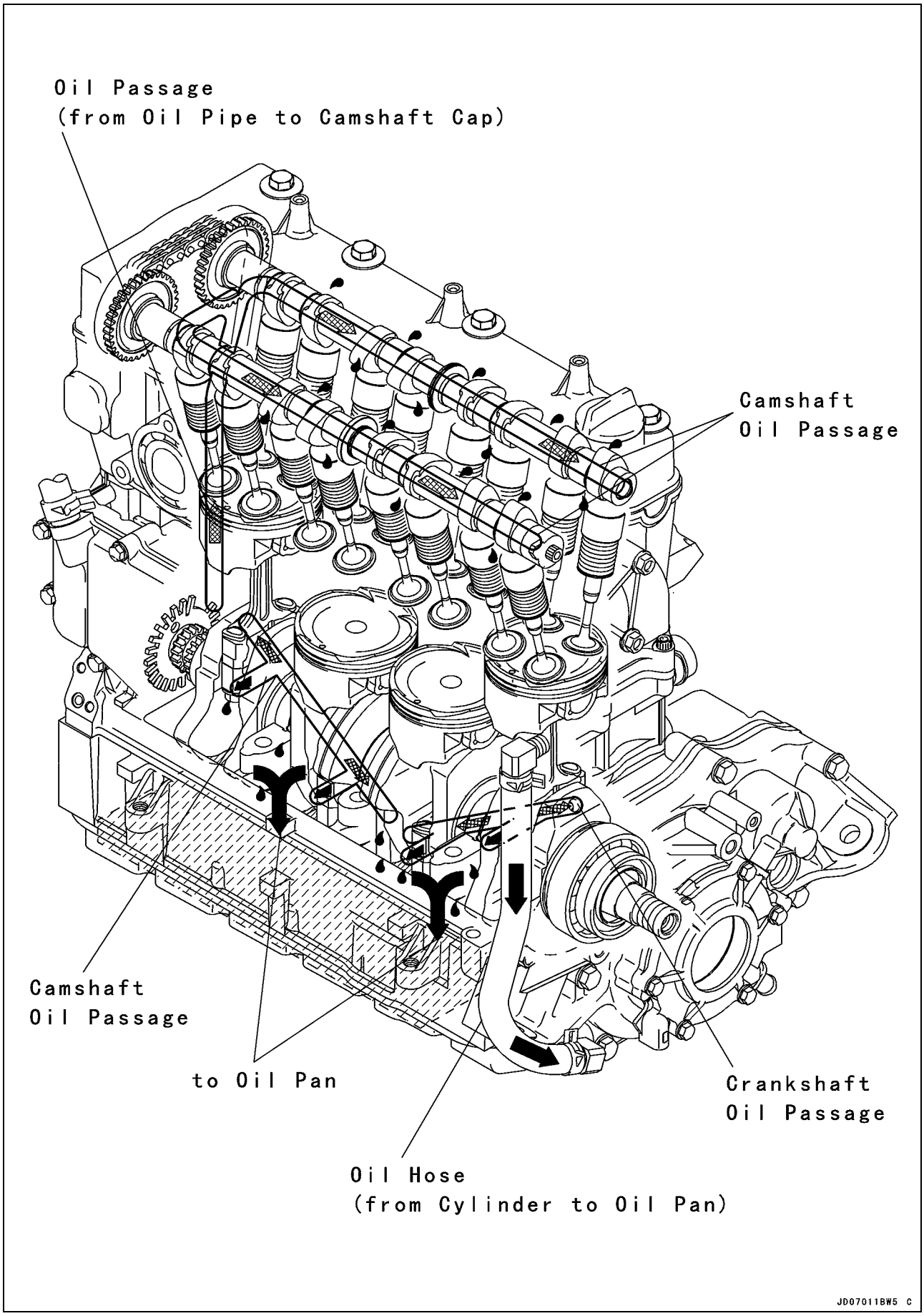


Engine Oil Flow Chart

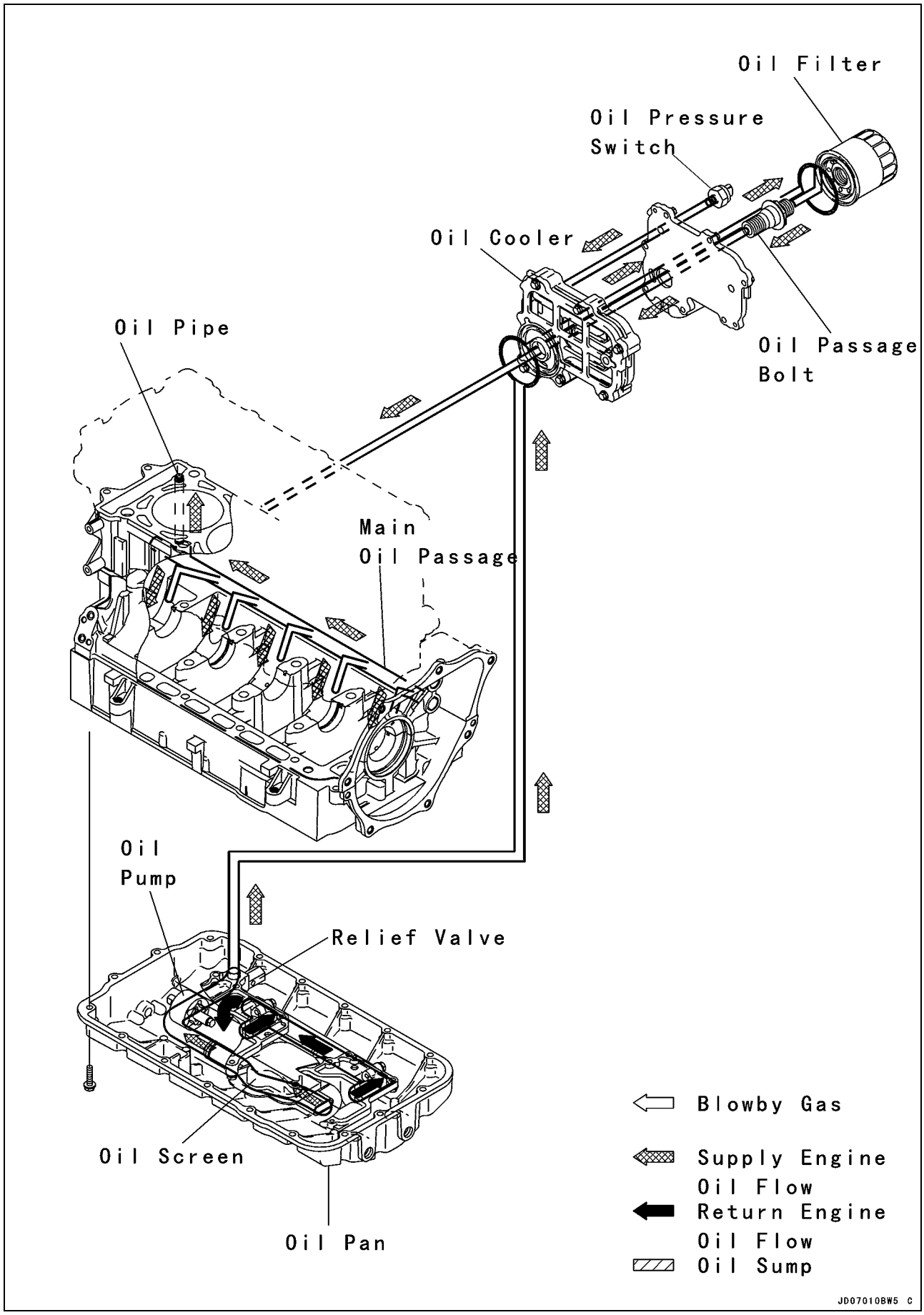
JT1500B8F



Engine Oil Flow Chart



Engine Oil Flow Chart



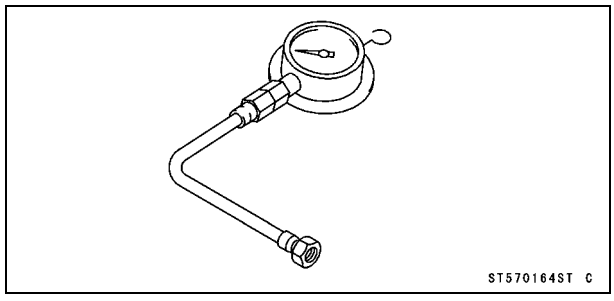
4-8 ENGINE LUBRICATION SYSTEM

Specifications

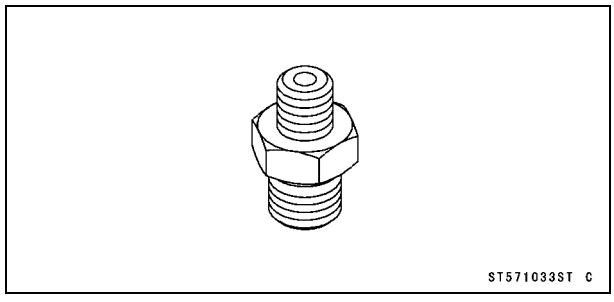
Item	Standard
Engine Oil	
Grade	API SE, SF, or SG API SH, SJ or SL with JASO MA
Viscosity	SAE 10W-40
Capacity	4.0 L (4.2 US qt, with or without the filter) 5.0 L (5.3 US qt, when engine is completely dry)
Level	Between upper and lower level lines (see text)
Oil Pressure Measurement	
Oil pressure @3 000 r/min (rpm), oil temperature 74°C (165°F)	461 kPa (4.7 kgf/cm², 67 psi)

Special Tool and Sealant

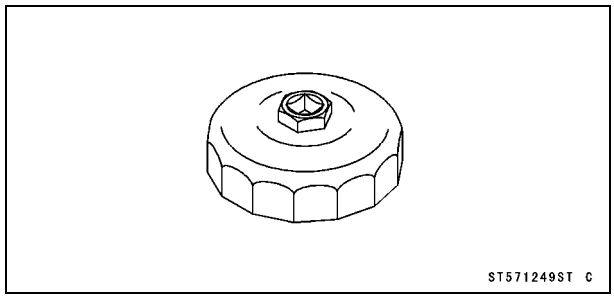
Oil Pressure Gauge, 10 kgf/cm²:
57001-164



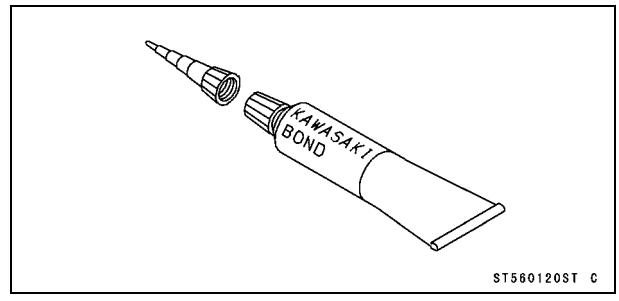
Oil Pressure Gauge Adapter, PT 1/8:
57001-1033



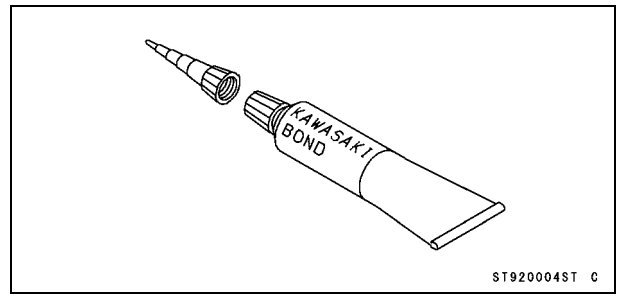
Oil Filter Wrench:
57001-1249



Kawasaki Bond (Silicone Sealant):
56019-120



Kawasaki Bond (Silicone Sealant):
92104-0004



Engine Oil and Oil Filter

⚠ WARNING

Watercraft operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated wear and may result in engine seizure, accident, and injury.

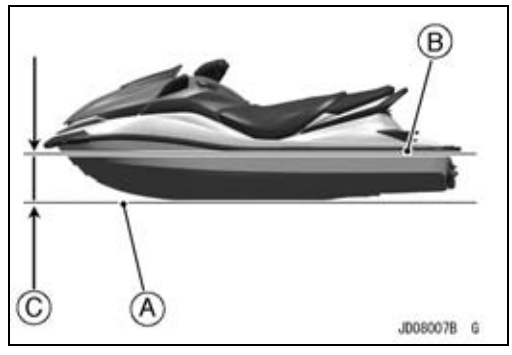
Oil Level Inspection

This watercraft engine is equipped with a semi-dry sump. In the semi-dry sump engine, the oil level difference is very large between the level measured after just stopping and that after leaving for a long time.

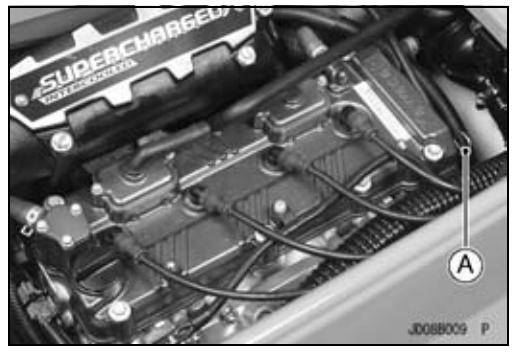
It is necessary to check the specified amount of oil is in the engine before starting the engine every day. At this time use the cold mark of the level gauge. Then run the engine to lubricate the engine parts sufficiently. After that it is necessary to check the level by using hot mark of the level gauge.

Preliminary Check

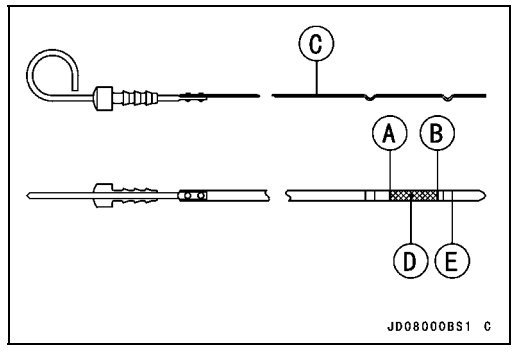
- Remove the seat (see Hull/Engine Hood chapter).
- Whenever checking the engine oil level, keep the watercraft level side to side and fore to aft as much as possible.
  Level Ground [A]
  Side Bumper [B]
  Parallel [C]



- Remove the dipstick [A], wipe it dry and insert it back to the dipstick tube, and then remove it again to check the oil level.



- The oil level must be between the High [A] and Low [B] level lines on the dipstick [C] (Use level lines when engine is cold).
  High Level Line when Cold [A]
  Low Level Line when Cold [B]
  Dipstick [C]
  High Level Line when Hot [D]
  Low Level Line when Hot [E]



Engine Oil and Oil Filter

CAUTION

Racing the engine before the oil reaches every part can cause engine seizure.
If the engine oil gets extremely low or if the oil pump or oil passages clog up or otherwise do not function properly, the oil pressure warning light will light. If this light stays on when the engine is running above idle speed, stop the engine immediately and find the cause.

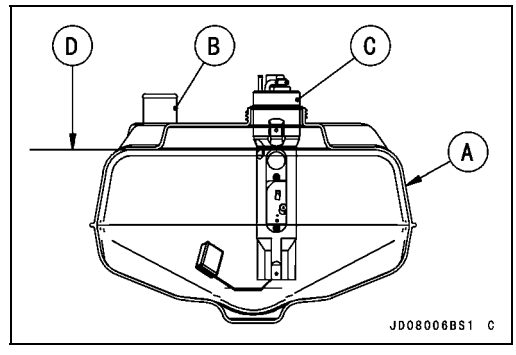
★If the oil level is too high, remove the excess oil using a syring or some other suitable device.
★If the oil level is too low, add the oil to the low level line through the oil filter opening (see Periodic Maintenance chapter). Use the same type and make of oil that is already in the engine.

NOTE

○*If the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.*

Ordinary (standard) Check

- The preliminary is checked before the ordinary check.
- Install the removed parts.
- Launch the watercraft.
- Start the engine for several minutes.
- Ride the watercraft and run the engine at about 5 000 rpm for 5 minutes.
- Stop the engine and let it cool down for 10 minutes.
- Steady the watercraft in calm water to prevent movement, or on the ground, keep the watercraft level side to side and fore to aft as much as possible.

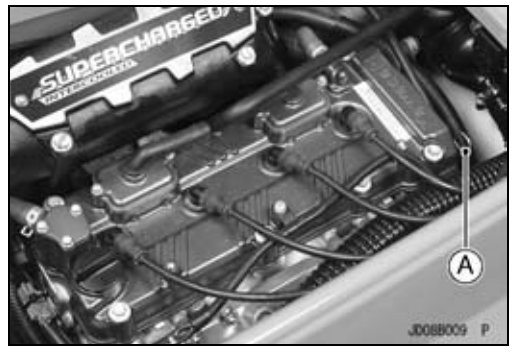


NOTE

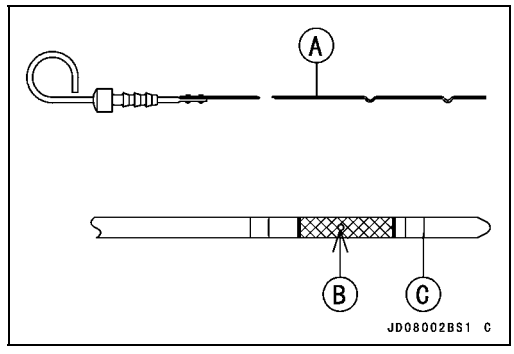
○*Since the trim and list of the watercraft will significantly affect the oil level, be sure that the operator and/or cargo are not aboard the watercraft when measuring the oil level.*
○*Also make the fuel tank [A] full if it is not full as shown to keep the watercraft level.*
Fuel Tank Filler Neck [B]
Fuel Full Level [C]
Fuel [D]
○*This measuring procedure with the watercraft afloat should be followed when the oil level is found low and to be added.*

Engine Oil and Oil Filter

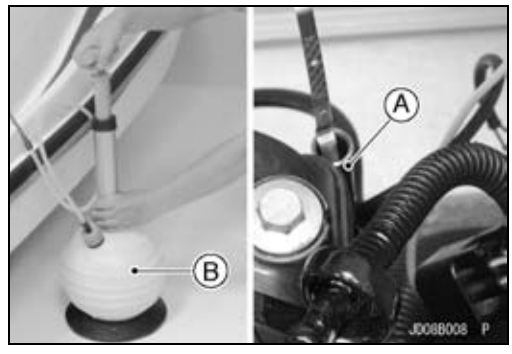
- Remove the seat (see Hull/Engine Hood chapter)
- Remove the dipstick [A], wipe it dry and insert it back to the dipstick tube, and then remove it again to check the oil level.



- Check the oil level using the hot level mark on the dipstick [A].
  High Level Line when Hot [B]
  Low Level Line when Hot [C]



★If the oil level is too high, drain the excess oil thoroughly from the dipstick tube [A] using a commercially-available vacuum pump [B].



★If the oil level is too low, add the oil to the high level line through the oil filler opening (see Periodic Maintenance chapter). Use the same type and make of oil that is already in the engine.

NOTE

○*If the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.*

Engine Oil Change

- Refer to Engine Oil Change in the Periodic Maintenance chapter.

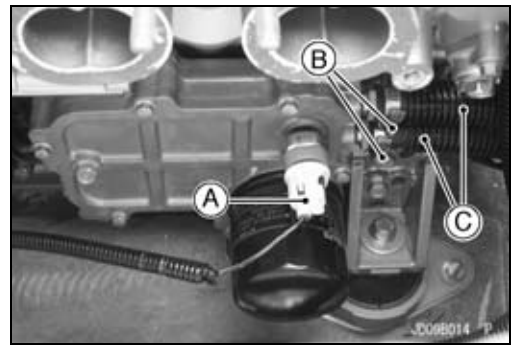
Oil Filter Replacement

- Refer to Oil Filter Replacement in the Periodic Maintenance chapter.

Oil Cooler

Oil Cooler Removal

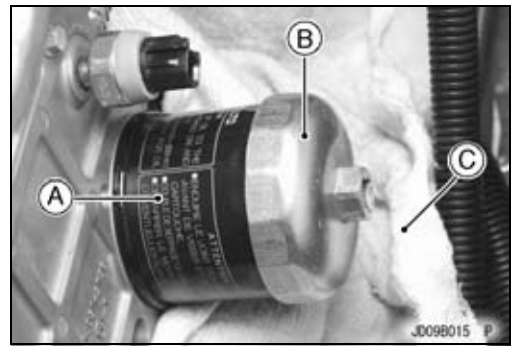
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Inlet Manifold (see Fuel System (DFI) chapter)
- Disconnect the oil pressure switch connector [A].
- Loosen the clamp screws [B] and remove the oil cooler cooling hoses [C] from the oil cooler.



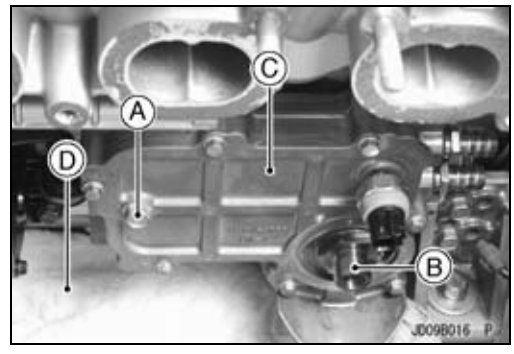
- Remove the oil filter [A] with the oil filter wrench [B].

○Place a rag or cloth [C] under the oil filter to receive the remaining oil.

Special Tool - Oil Filter Wrench: 57001-1249

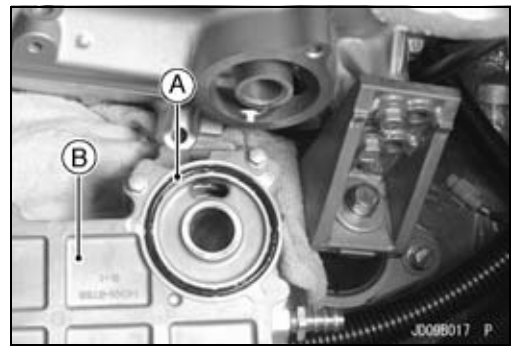


- Unscrew the oil cooler positioning bolt [A].
- Unscrew the oil passage bolt [B] and remove the oil cooler [C].
- Place a rag or cloth [D] under the oil cooler to receive the remaining oil.



Oil Cooler Installation

- Replace the O-ring [A] with new one and apply grease to new O-ring.
- Fit the O-ring on the oil cooler [B] securely.

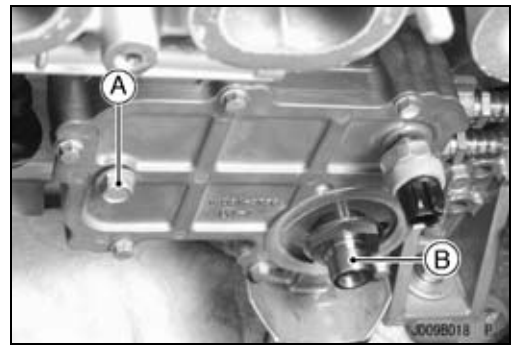


- Install the oil cooler positioning bolt [A] and the oil passage bolt [B] temporarily.

○Tighten the passage bolt first.

○Next, tighten the positioning bolt.

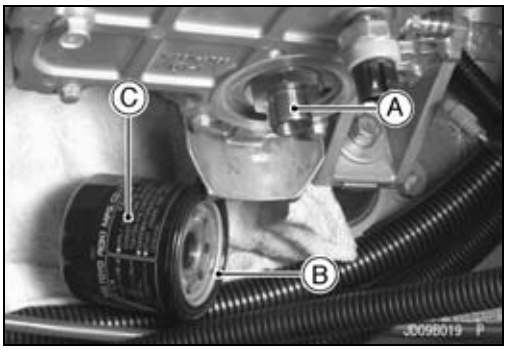
Torque - Oil Passage Bolt: 78 N·m (8.0 kgf·m, 58 ft·lb)
Oil Cooler Positioning Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)



Oil Cooler

- Apply engine oil to the thread [A] of the passage bolt and O-ring [B] of the oil filter [C].
- Tighten the oil filter (P/No. 16097-1072).

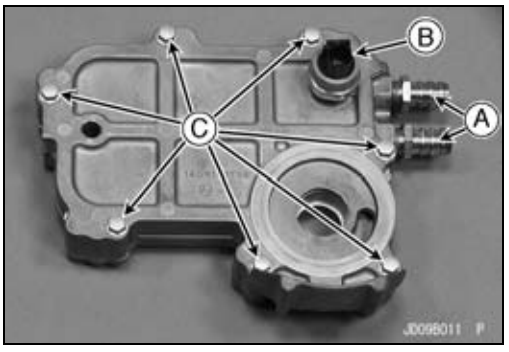
Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)



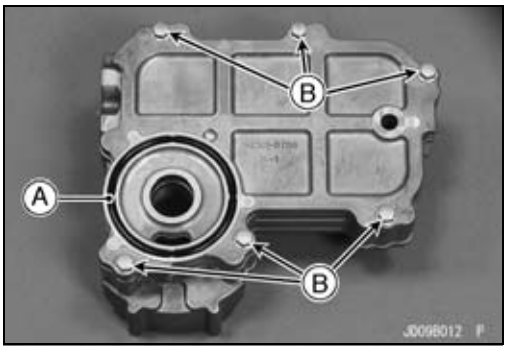
- Connect the oil pressure switch connector securely.
- Install the cooling hoses (see Cable, Wire and Hose Routing in Appendix chapter).
- Install the inlet manifold (see Fuel System (DFI) chapter).

Oil Cooler Disassembly

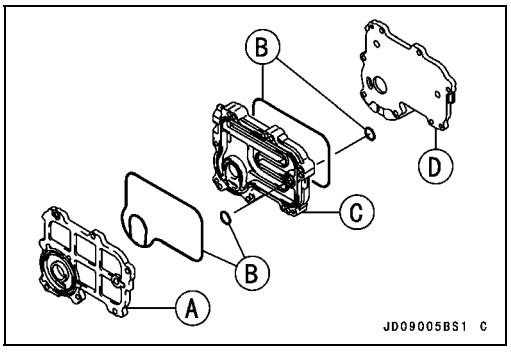
- Remove:
  Oil Cooler (see Oil Cooler Removal)
  Water Hose Joints [A]
  Oil Pressure Switch [B]
  Oil Cooler Assembly Bolts [C]



- Remove the O-ring [A].
- Turn the oil cooler up side down, and remove the assembly bolts [B].



- Separate the oil cooler.
  Inside Oil Cooler Cover [A]
  O-rings [B]
  Oil Cooler [C]
  Outside Oil Cooler Cover [D]



Oil Cooler Assembly

- Apply grease to new O-rings, and fit them on to each groove of the coolers securely.
- Apply silicon sealant to the joints and tighten them.

Sealant - Kawasaki Bond (Silicone Sealant): 56019-120

Torque - Oil Cooler Assembly Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)
Water Hose Joints: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Install the oil cooler (see Oil Cooler Installation).

Oil Cooler

Oil Cooler Inspection

● Start the engine to check for water and oil leaks.

★If the water and oil leak, replace the O-rings.

⚠ WARNING

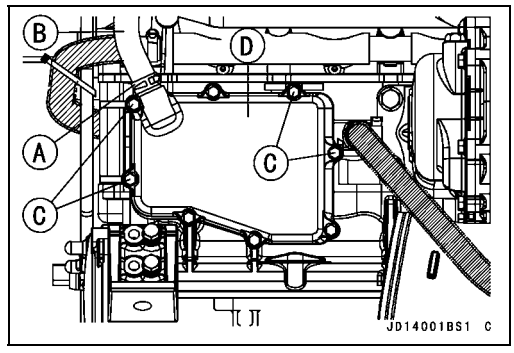
Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas which can be lethal.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

Breather Case and Oil Separator Tank

Breather Case Removal (JT1500B7F Model)



- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Exhaust Manifold (see Exhaust Manifold Removal in the Exhaust System chapter)
  Clamp [A]
  Breather Hose [B]
  Breather Case Mounting Bolts [C]
- Pull the breather case [D] upward.

Breather Case Installation (JT1500B7F Model)

★If the breather pipe [A] removed, install the pipe as follow.
○Apply grease to the O-ring [B].
○Install the O-ring to the short length pipe side [C] of the breather pipe.
○Install the breather pipe so that the short length pipe side faces downward.

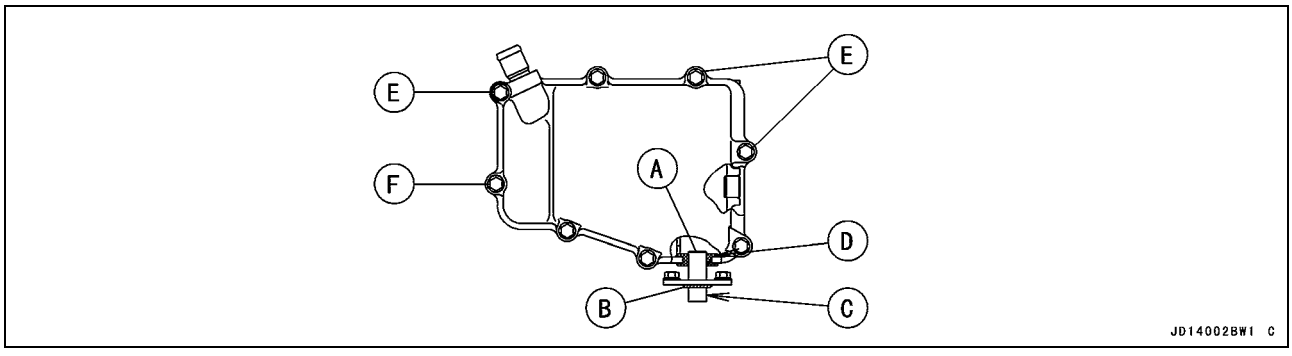
Torque - Breather Pipe Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Apply silicone sealant to the inside of the rubber grommet [D].

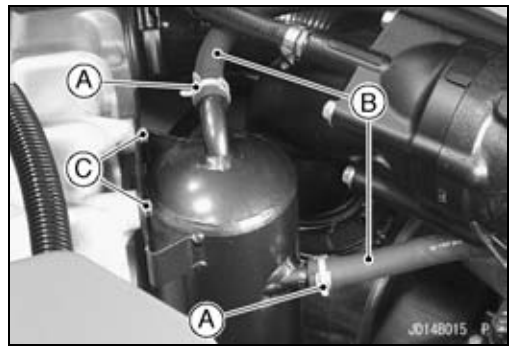
Sealant - Kawasaki Bond (Silicone Sealant): 92104-0004

- Tighten the breather case mounting bolts.
  M6 × 55 Bolts [E]
  M6 × 45 Bolt [F]

Torque - Breather Case Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Oil Separator Tank Removal



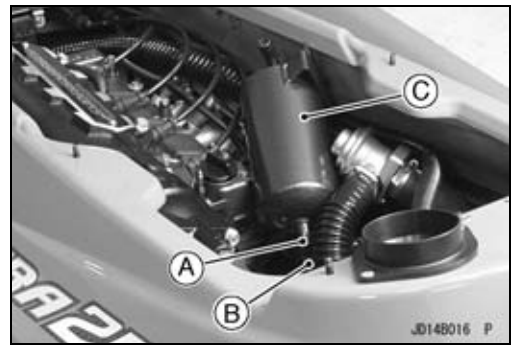
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Handrail Plate (see Handrail Plate Removal in the Hull/Engine Hood chapter)
  Breather Hose Clamps [A]
  Breather Hoses [B]
  Mounting Bolts and Waters [C]

Breather Case and Oil Separator Tank

● Remove:
Breather Hose Clamp [A]
Breather Hose [B]
Oil Separator Tank [C]

NOTE

○*Hold the hose end to the upward. The oil will flow out if the hose lies at the bottom.*



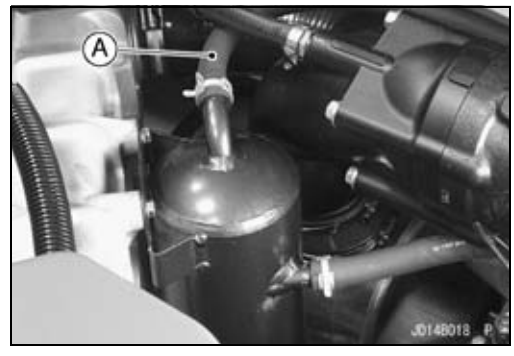
Oil Separator Tank Installation

● When installing the breather hoses, avoid sharp bending, kicking, flattening or twisting, and route the hoses according to Hose Routing section in Appendix chapter.
● Apply a non-permanent locking agent to the oil separator tank mounting bolts.
● Tighten:
○Be careful not to drop the nuts.

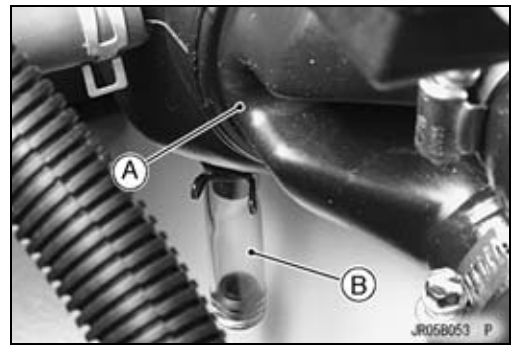
Torque - Oil Separator Tank Mounting Bolts: 4.9 N·m (0.50 kgf·m, 43 in·lb)

Blowby Gas System Inspection

● Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly.
★If they are not, correct them.
● Inspect the breather hoses [A], breather pipes and the air filter drain caps for damage or signs of deterioration. Squeeze the hoses. These hoses should not be hard and brittle, nor should be soft or swollen.
★Replace any damaged hoses.
● Check that the hoses and aps are securely connected.



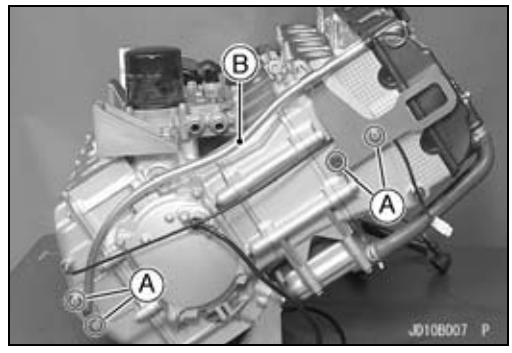
○The air box drain caps [B] is provided beneath the air box [A]. The drain cap catches the water or oil from the bottom of the air box housing. Usually water or oil does not collect at the bottom of the housing. In the event that water is drawn in through the duct, or if engine oil is blown back, drain the housing.
● Pull the air box drain plugs to drain the water or breather oil when changing engine oil.



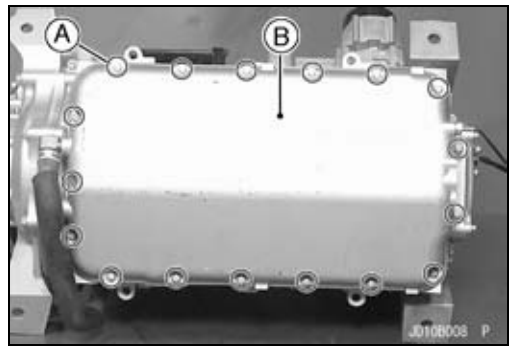
Oil Pan

Oil Pan Removal

- Remove:
  Engine Oil (drain, see Periodic Maintenance chapter)
  Engine (see Engine Removal/Installation chapter)
- Turn the engine to the side.
- Unscrew the dipstick tube bolts [A] and pull out the dipstick tube [B].



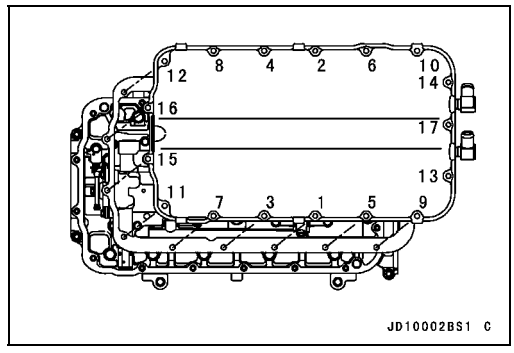
- Unscrew the oil pan bolts [A] and remove the oil pan [B].



Oil Pan Installation

- Tighten the oil pan bolts following the tightening sequence [1 ~ 17].

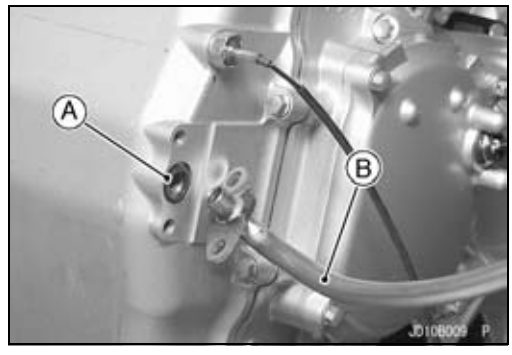
  Torque - Oil Pan Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



- Apply grease to the O-ring [A] on the dipstick tube [B].
- Apply a non-permanent locking agent to the dipstick tube bolts.
- Tighten all the dipstick tube bolts temporary.

○First, tighten the oil pan side bolt. Next, tighten the cylinder head side bolts.

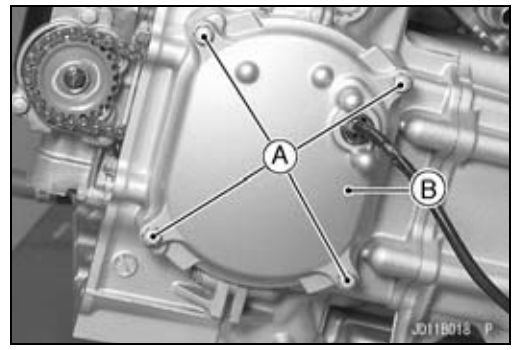
Torque - Dipstick Tube Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

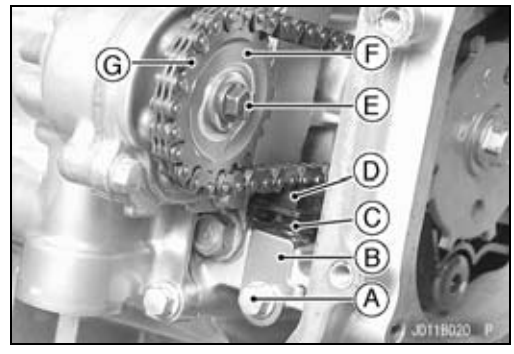
Oil Pump Sprocket Removal

- Drain:
  Engine Oil (see Periodic Maintenance chapter)
- Remove:
  Engine (see Engine Removal/Installation chapter)
  Oil Pan (see Oil Pan Removal)
  Crankshaft Sensor Cover Bolts [A]
  Crankshaft Sensor Cover [B]



- Unscrew the oil pump chain guide bolt [A],

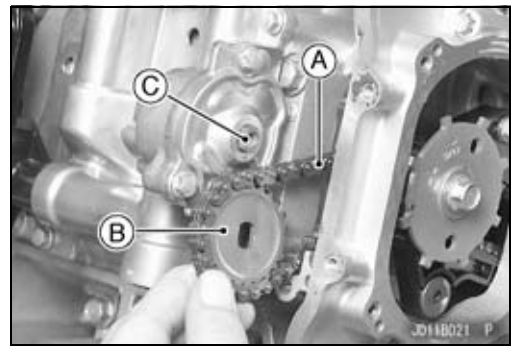
- Unscrew the spring plate bolt [A] and remove the spring plate [B], spring [C] and the oil pump chain guide [D].
- Unscrew the oil pump sprocket bolt [E].
- Pull out the oil pump sprocket [F] together with the oil pump sprocket chain [G].



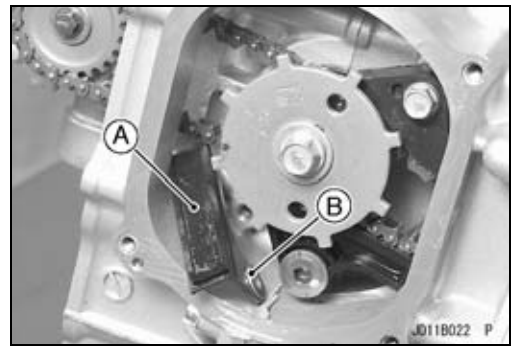
Oil Pump Sprocket Installation

- Engage the oil pump chain [A] to the oil pump sprocket [B].
- Install the sprocket with the chain to the oil pump shaft [C].
- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the sprocket bolt.
- Tighten:

Torque - Oil Pump Sprocket Bolt: 16 N·m (1.6 kgf·m, 12 ft·lb)

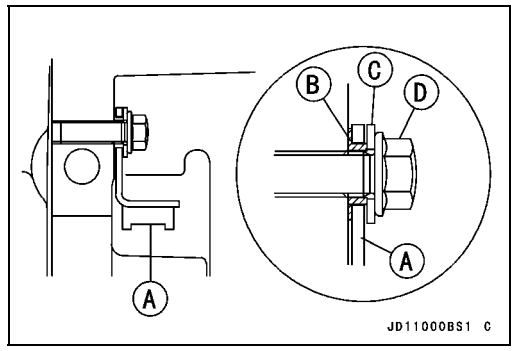


- Install the oil pump chain guide [A] and collar [B] as shown.



Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

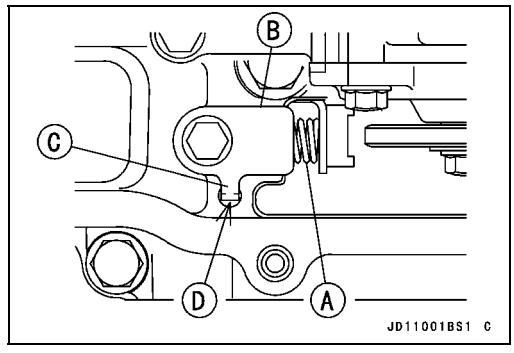
● Install the oil pump chain guide [A], collar [B], washer [C], and bolt [D] as shown.



● Install the chain guide spring [A] and the spring plate [B].
○Insert the tab [C] of the spring plate in the hole [D] of the crankcase.

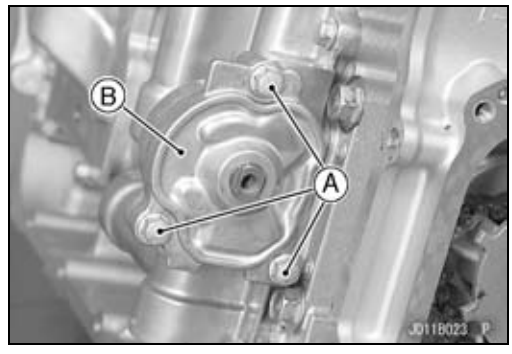
Torque - Chain Guide Spring Plate Bolt: 7.8 N·m (0.80 kgf·m, 69 in·lb)

● Install:
Oil Pan (see Oil Pan Installation)

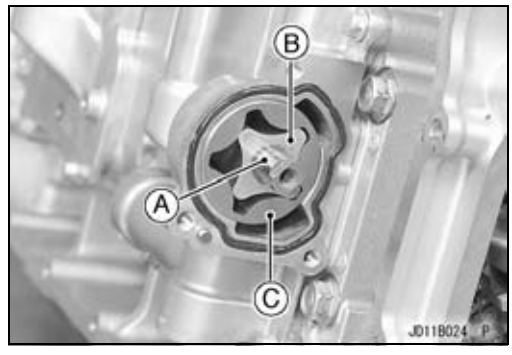


Oil Pump Removal

● Drain:
Engine Oil (see Periodic Maintenance chapter)
● Remove:
Engine (see Engine Removal/Installation chapter)
Oil Pan (see Oil Pan Removal)
Oil Pump Sprocket (see Oil Pump Sprocket Removal)
Oil Pump Cover Bolts [A]
● Pull out the oil pump cover [B].



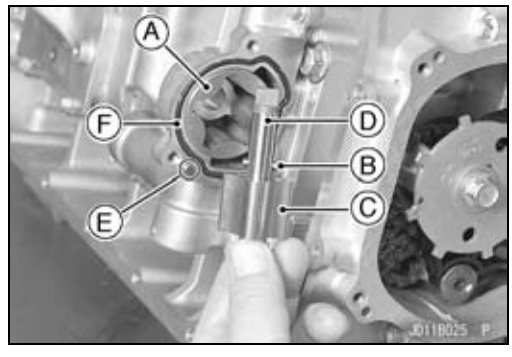
● Pull out the oil pump shaft [A] with inner rotor [B].
● Remove the outer rotor [C].



Oil Pump Installation

● Apply molybdenum disulfide oil solution to the outer and the inner rotors out side.
● Install the outer rotor [A] into the oil pump body.
● Apply molybdenum disulfide oil solution to the shaft.
● Assemble the pin [B] , inner rotor [C] onto the oil pump shaft [D].
○Fit the pin into the slot of the inner rotor.
● Insert the shaft assembly.
● Be sure the dowel pin [E] is in place in the pump body.
● Fit the new O-ring [F] to the groove of the pump body.
● Fit the oil pump cover and tighten the cover bolts.

Torque - Oil Pump Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

- Install:
  Oil Pump Sprocket (see Oil Pump Sprocket Installation)
  Oil Pan (see Oil Pan Installation)

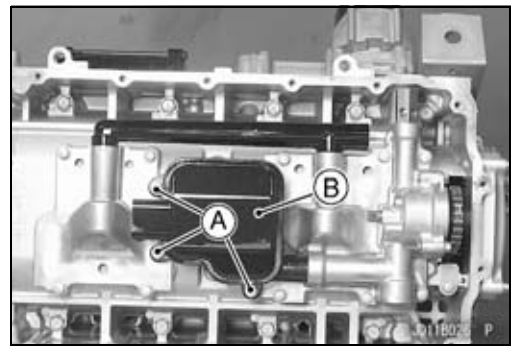
Oil Pump Inspection

- Remove the oil pump parts.
- Visually inspect the oil pump outer, inner rotors and cover.

★If there is any damage or uneven wear, replace the rotors and cover.

Oil Screen Removal

- Remove:
  Engine (see Engine Removal/Installation chapter)
  Oil Pan (see Oil Pan Removal)
  Oil Screen Bolts [A]
- Pull out the oil screen [B] to the coupling side.

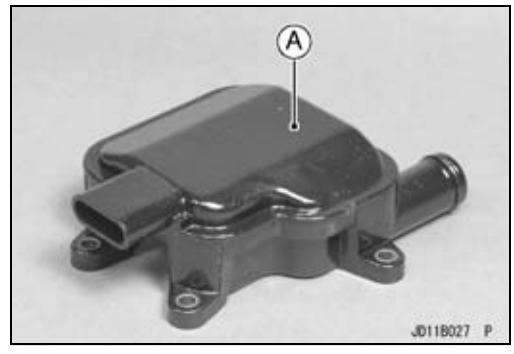


Oil Screen Installation

- Clean the oil screen [A] with high-flash point solvent and remove any particles stuck to it.

⚠ WARNING

Clean the screen in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents.



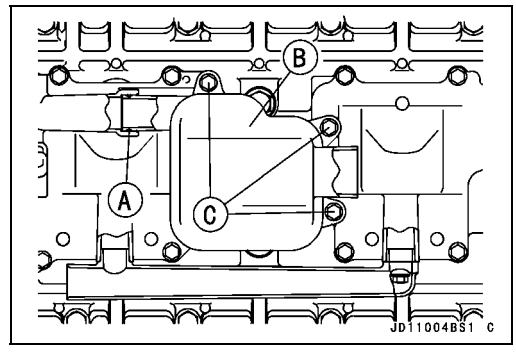
NOTE

○*While cleaning the screen, check for any metal particles that might indicate internal engine damage.*

- Apply grease to the O-ring [A].
- Install the oil screen [B].
- Tighten:

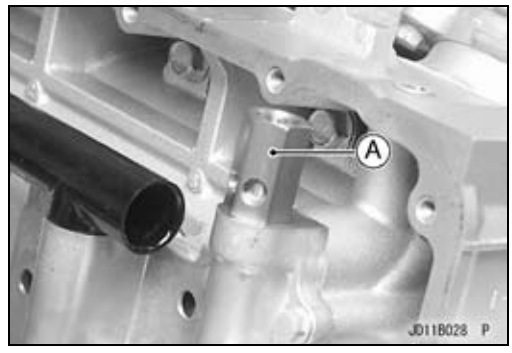
Torque - Oil Screen Bolts [C]: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install:
  Oil Pan (see Oil Pan Installation)

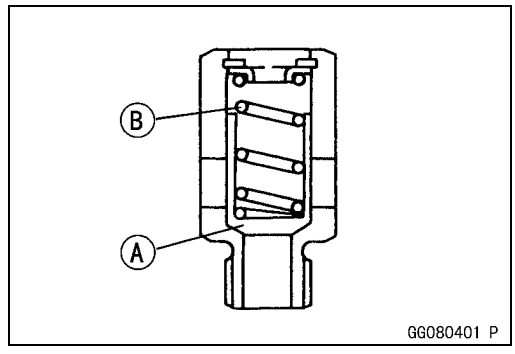


Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

Oil Pressure Relief Valve Inspection



- Remove:
  Oil Pan (see Oil Pan Removal)
  Relief Valve [A]



- Check to see if the valve [A] slides smoothly when pushing it in with a wooden or other soft rod, and see if it comes back to its seat by spring [B] force.

NOTE

○*Inspect the valve in its assembled state. Disassembly and assembly may change the valve performance.*

★If any rough spots are found during above inspection, wash the valve clean with a high-flash point solvent and blow out any foreign particles that may be in the valve with compressed air.

⚠ WARNING

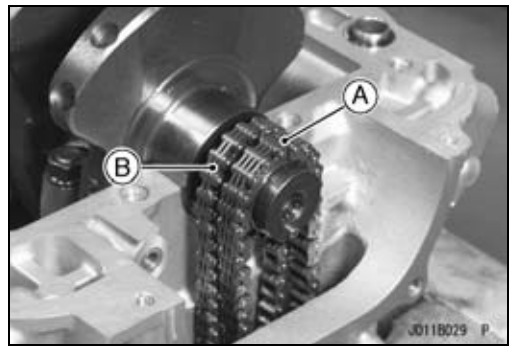
Clean the relief valve in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. Because of the danger of highly flammable liquids, do not use gasoline or low -flash point solvent.

★If cleaning does not solve the problem, replace the relief valve as an assembly. The relief valve is precisely made with no allowance for replacement of individual parts.

- Apply a non-permanent locking agent to the relief valve.
- Install the relief valve.

Torque - Oil Pressure Relief Valve: 15 N·m (1.5 kgf·m, 11 ft ·lb)

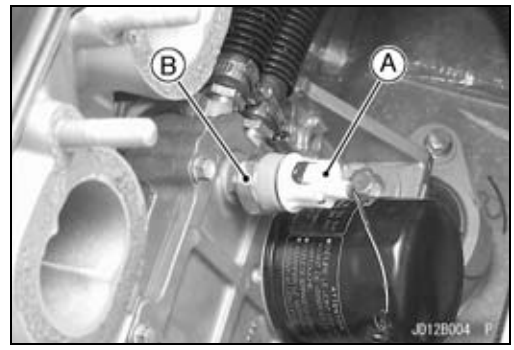
Oil Pump Sprocket Chain Removal



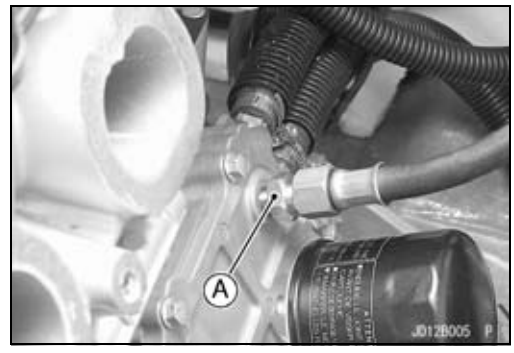
- Split the crankcase (see Engine Bottom End chapter).
- Remove the camshaft chain [A] and the oil pump sprocket chain [B].

Oil Pressure Measurement

Oil Pressure Measurement

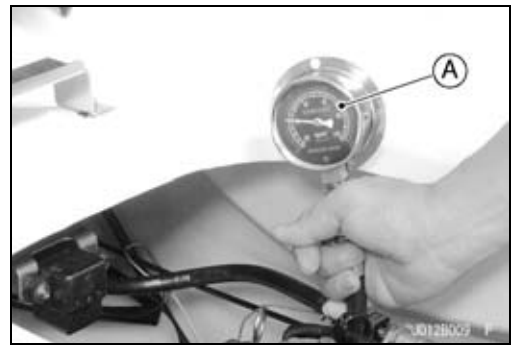


- Remove:
  Seat (see Hull/Engine Hood chapter)
  Inlet Manifold (see Fuel System (DFI) chapter)
  Oil Pressure Switch Connector [A] (disconnect)
  Oil Pressure Switch [B]



- Install the oil pressure gauge adapter [A] to the switch hole.

  Special Tool - Oil Pressure Gauge Adapter, PT 1/8: 57001 -1033



- Install the oil pressure gauge [A] to the adapter.

  Special Tool - Oil Pressure Gauge, 10 kgf/cm²: 57001-164

- Install:
  Inlet Manifold (see Fuel System (DFI) chapter)

- Launch the watercraft.
- Start the engine for several minutes.
- Run the engine at the specified speed, and read the oil pressure gauge.

★If the oil pressure is significantly below the specification, inspect the oil pump and relief valve.

★If the oil pump and relief valve are not at fault, inspect the rest of the lubrication system.

Oil Pressure

Standard: 461 kPa (4.7 kgf/cm², 67 psi) @3 000 r/min (rpm), oil temperature 74°C (165°F)

- Stop the engine.
- Raise the watercraft to the land.
- Remove:
  Inlet Manifold
  Oil Pressure Gauge and Adapter

Oil Pressure Measurement

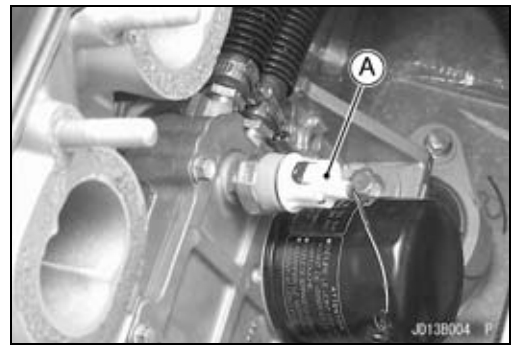
⚠ WARNING

Take care against burns from hot engine oil that will drain through the oil passage when the gauge adapter is removed.

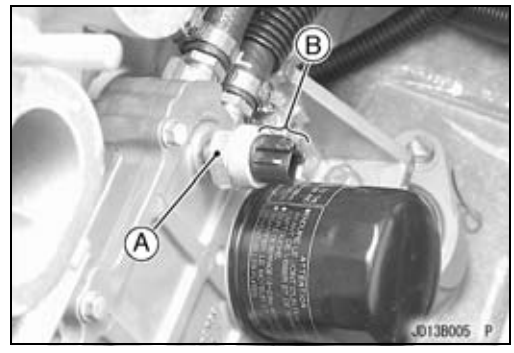
- Install:
  Oil Pressure Switch (see Oil Pressure Switch Installation)
  Inlet Manifold

Oil Pressure Switch

Oil Pressure Switch Removal



- Remove:
  Seat (see Hull/Engine Hood chapter)
  Inlet Manifold (see Fuel System (DFI) chapter)
- Disconnect:
  Switch Connector [A]



- Place a rag or cloth under the oil pressure switch [A] and remove the oil pressure switch.

○Do not damage the connect part [B] of the switch.

Oil Pressure Switch Installation

- Apply silicone sealant to the threads of the oil pressure switch and tighten it.

  Sealant - Kawasaki Bond (Silicone Sealant): 56019-120

  Torque - Oil Pressure Switch: 15 N·m (1.5 kgf·m, 11 ft·lb)

- Connect the switch connector.
- Install the removed parts.

Exhaust System

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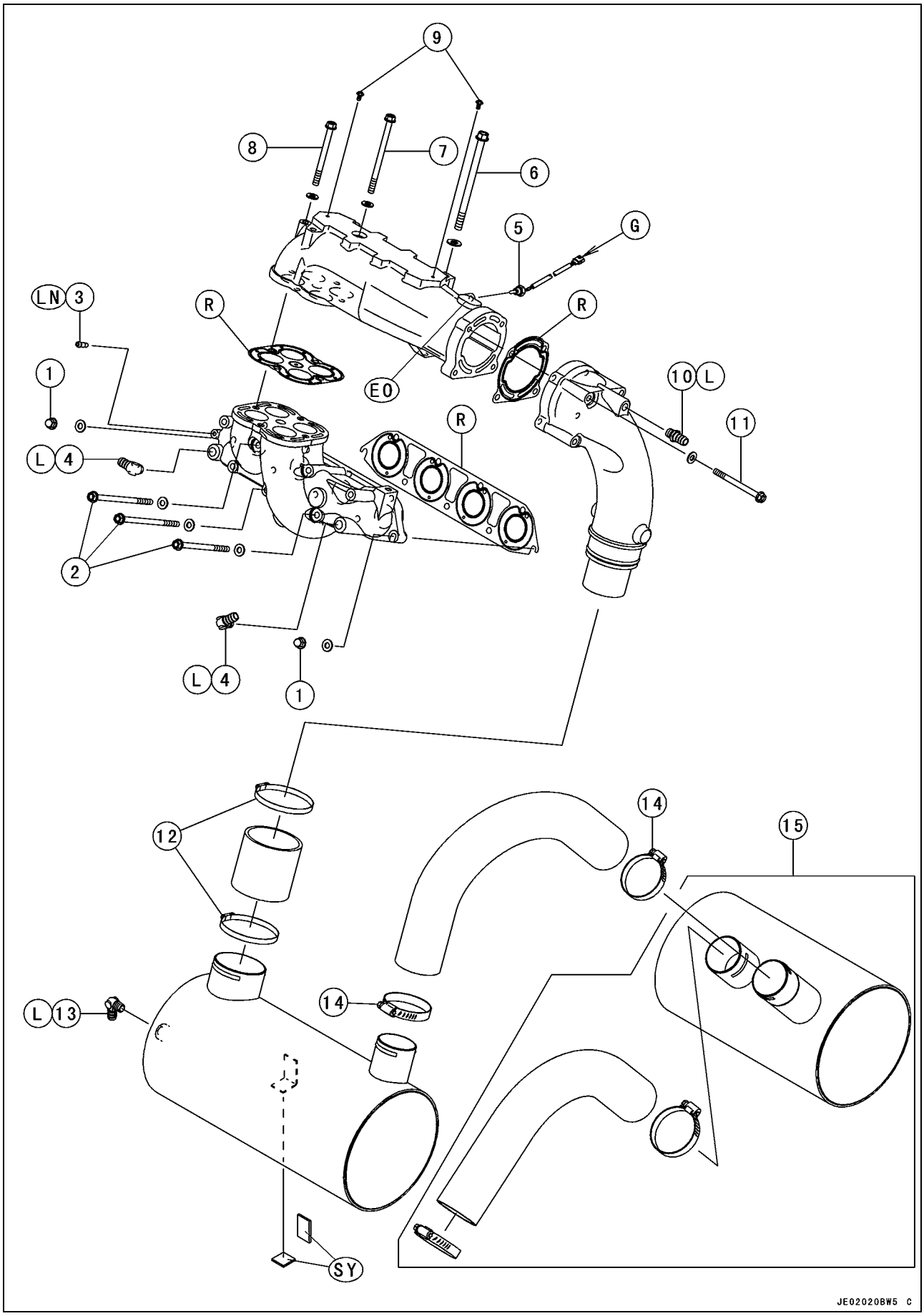
5-2 EXHAUST SYSTEM

Exploded View



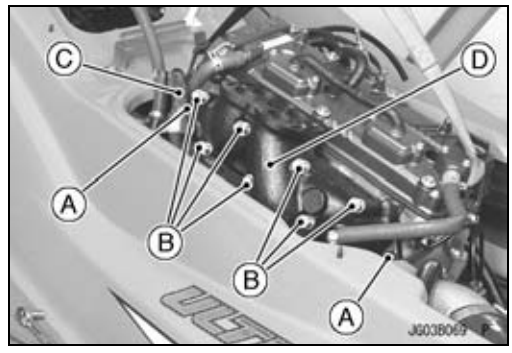
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Manifold Mounting Nuts	30	3.1	22	
2	Exhaust Manifold Mounting Bolts	30	3.1	22	
3	Bypass Nozzle	–	–	–	LN
4	Flushing Hose Joints	11	1.1	95 in·lb	L
5	Water Temperature Sensor	15	1.5	11	see chapter 3
6	Exhaust Pipe Mounting Bolt (L = 150 mm)	45	4.6	33	
7	Exhaust Pipe Mounting Bolts (L = 120 mm)	35	3.6	26	
8	Exhaust Pipe Mounting Bolts (L = 95 mm)	35	3.6	26	
9	Mark Plate Bolts	5.0	0.51	44 in·lb	
10	Water Hose Joint	20	2.0	14	L
11	Muffler Body Bolts	35	3.6	26	
12	Front Exhaust Tube Clamp Screws (JT1500B7F)	2.9	0.30	26 in·lb	
	Front Exhaust Tube Clamp Screws (JT1500B8F)	4.9	0.50	43 in·lb	
13	Water Hose Joint	11	1.1	95 in·lb	L
14	Rear Exhaust Tube Clamp Screws (JT1500B8F)	4.9	0.50	43 in·lb	

15. JT1500B7F Model
EO: Fill the hollow with the engine oil (10W-30).
G: Apply grease.
L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
R: Replacement Parts
SY: Apply synthetic rubber adhesive.

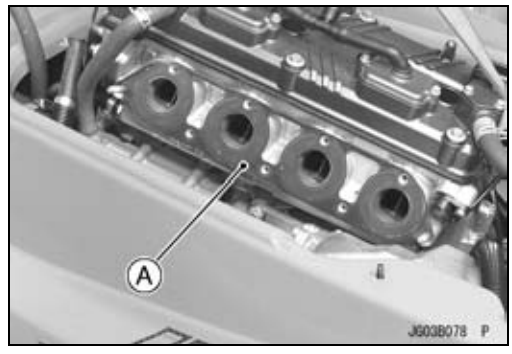
Exhaust Manifold

Exhaust Manifold Removal



- Refer to Engine Removal in the Engine Removal/Installation chapter.
- Using the lifter, lift the engine as shown.
- Unscrew the exhaust manifold nuts [A] and bolts [B].
- Disconnect the flushing hose [C].
- Remove the exhaust manifold [D].

Exhaust Manifold Installation



- Refer to Engine Installation in the Engine Removal/Installation chapter.
- Install the new gasket [A] before installing the exhaust manifold.
- Torque:

Torque - Exhaust Manifold Mounting Nuts: 30 N·m (3.1 kgf·m, 22 ft·lb)
Exhaust Manifold Mounting Bolts: 30 N·m (3.1 kgf·m, 22 ft·lb)

Exhaust Manifold Cleaning and Inspection

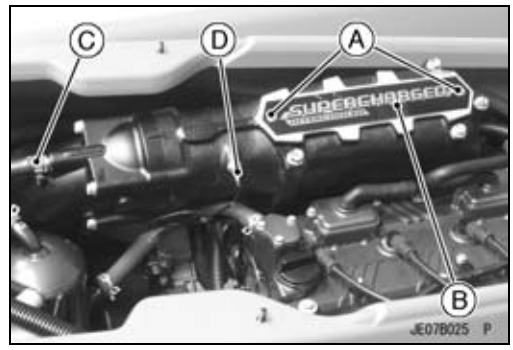
- Remove the exhaust manifold parts.
- Clean the carbon deposits out of the exhaust passages with a blunt, roundedged tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passages for corrosion. Check the gasket surfaces for nicks or other damage.

★If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.

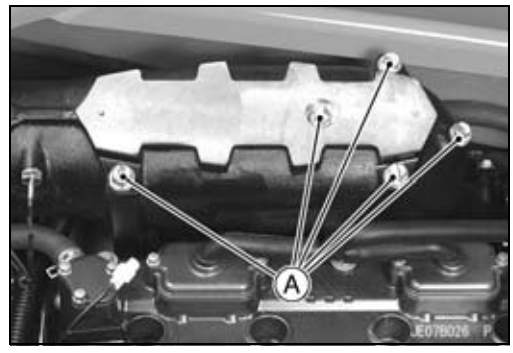
Exhaust Pipe and Muffler Body

Exhaust Pipe and Muffler Body Removal

- Remove the seats (see Seat Removal in the Hull/Engine Hood chapter).
- Remove the rear grip plate (see Rear Grip Plate Removal in the Hull/Engine Hood chapter).
- Remove:
  Mark Pate Bolts [A]
  Mark Plate [B]
  Cooling Hose [C] (Disconnect)
  Water Temperature Sensor [D] Connector (Disconnect)

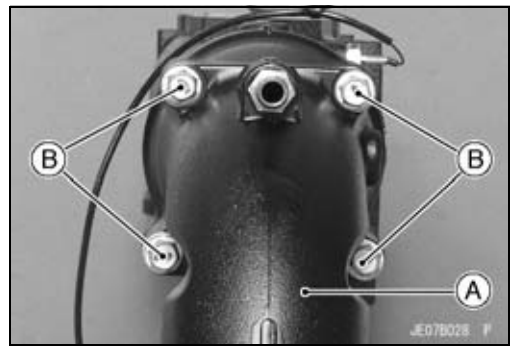


- Remove the exhaust pipe bolts [A].



- Loosen the clamp [A].
- Remove the exhaust pipe and muffler body [B] as a set.

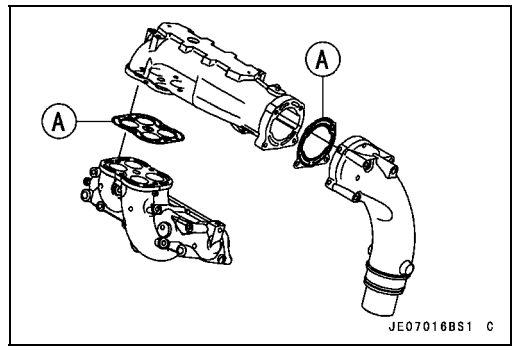
- To remove the muffler body [A] from the exhaust pipe, remove the bolts [B].



Exhaust Pipe and Muffler Body Installation

- Install the new gaskets [A].
- Torque:

Torque - Exhaust Pipe Mounting Bolt (L = 150 mm): 45 N·m (4.6 kgf·m, 33 ft·lb)
Exhaust Pipe Mounting Bolt (L = 120 mm): 35 N·m (3.6 kgf·m, 26 ft·lb)
Exhaust Pipe Mounting Bolt (L = 95 mm): 35 N·m (3.6 kgf·m, 26 ft·lb)
Mark Plate Bolts: 5.0 N·m (0.51 kgf·m, 44 in·lb)
Muffler Body Bolts: 35 N·m (3.6 kgf·m, 26 ft·lb)



Exhaust Pipe and Muffler Body

Exhaust Pipe and Muffle Body Cleaning and Inspection

- Remove the exhaust pipe and muffler body parts.
- Clean the carbon deposits out of the exhaust passages with a blunt, roundedged tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passage for corrosion.
- Check the gasket surface for nicks or other damage.

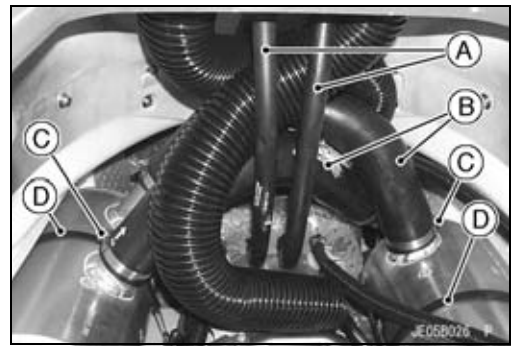
★If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.

Water Box Muffler

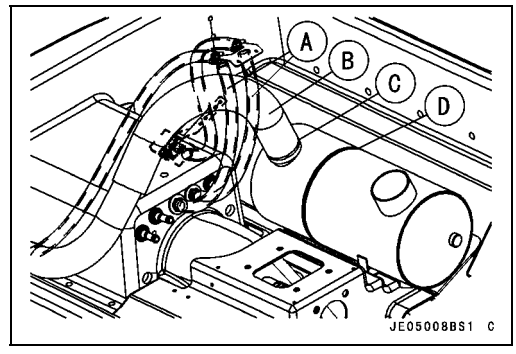
Water Box Muffler Removal

● Remove:
Oil Separator Tank with Oil Separator Hoses (see the Lubrication System chapter)
Exhaust Pipe and Muffler Body (see Exhaust Pipe and Muffler Body Removal)
Intercooler (see Intercooler Removal in the Cooling and Bilge System chapter)

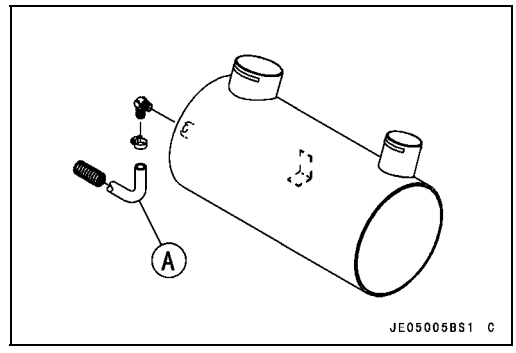
● Pull the bilge hoses [A] off the breathers.
● Remove the exhaust tubes [B] by loosing the clamp screws [C].
● Unhook the rubber straps [D] from the water box muffler.



● JT1500B8F Model
○Pull the bilge hoses [A] off the breathers.
○Remove the exhaust tube [B] by loosing the clamp screw [C].
○Unhook the rubber strap [D] from the water box muffler.

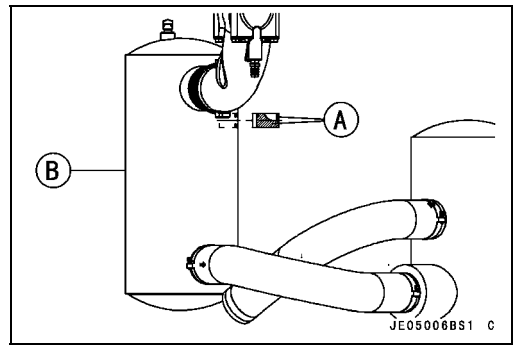


● Remove:
Cooling Hoses [A]
● Remove the water box mufflers.



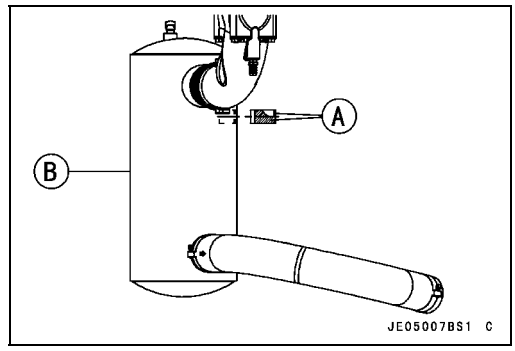
Water Box Muffler Installation

● Be sure the dampers [A] on the left side water box muffler [B] are in place.



Water Box Muffler

● JT1500B8F Model



● Tighten the clamp securing the front exhaust tube, noting its screw position, and check the hose routing and clamp screw position (see Cable, Wire and Hose Routing in Appendix chapter).

Water Box Muffler Inspection

● Remove the left water box muffler (JT1500B7F model).
● Remove the water box muffler (JT1500B8F model).
● Empty water out of the water box.
● Check the inlet spigot for damage caused by excessive heat.
★ If there is heat damage to the inlet spigot, check the cooling system for blockage (see Cooling System Cleaning and Inspection) and the fuel system for proper adjustment (see Fuel System chapter).

Engine Top End

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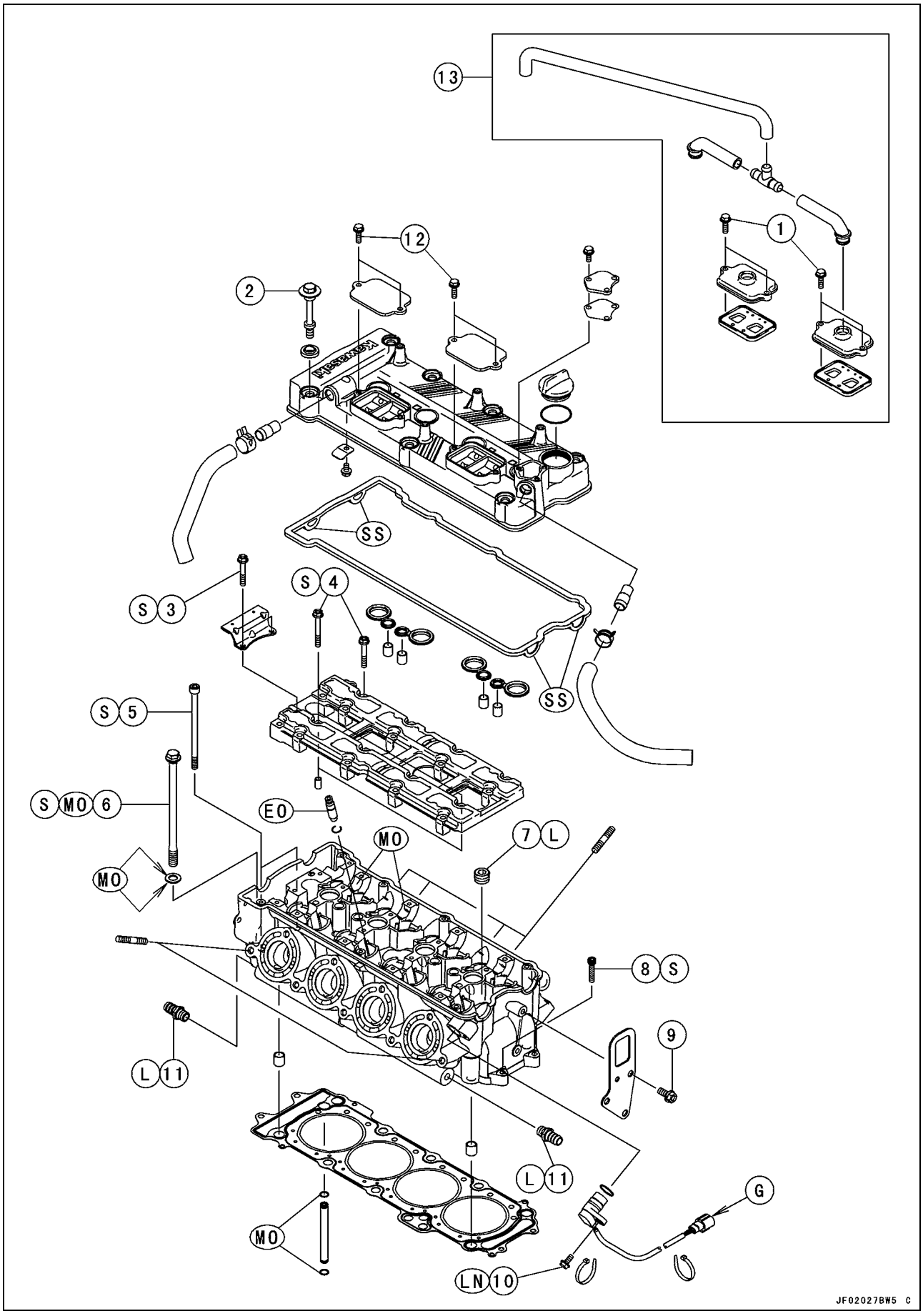
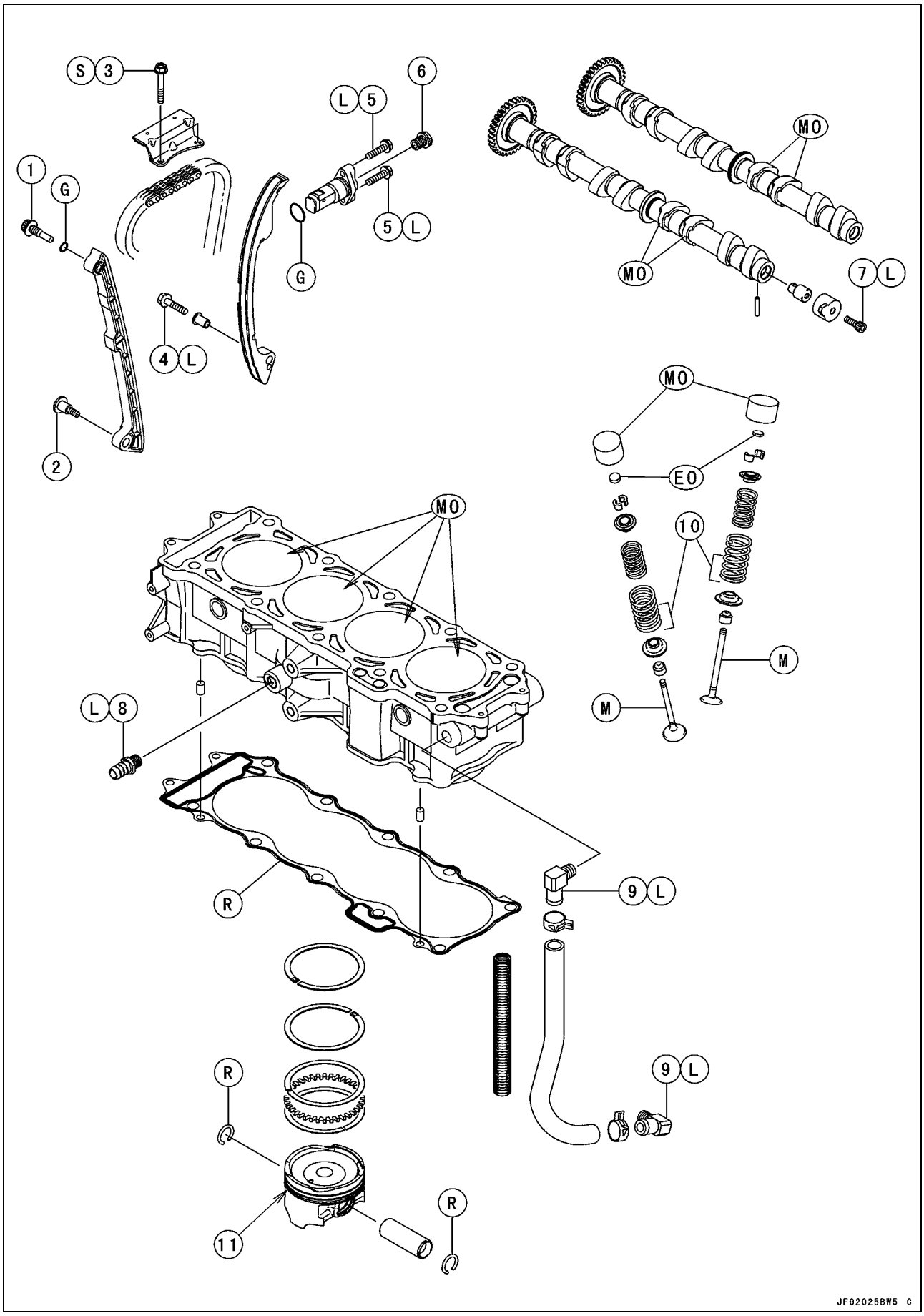


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Suction Valve Cover Bolts	9.8	1.0	87 in·lb	
2	Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
3	Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
4	Camshaft Cap Bolts	12	1.2	104 in·lb	S
5	Cylinder Head Bolts (M7)	20	2.0	14	S
6	Cylinder Head Bolts (M11)	23	2.3	17	First, MO, S
6	Cylinder Head Bolts (M11)	69	7.0	51	Final, MO, S
7	Water Jacket Plugs	20	2.0	14	L
8	Cylinder Head Bolts (M6)	12	1.2	104 in·lb	S
9	Engine Hook Bolts	20	2.0	14	
10	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
11	Water Hose Joints	20	2.0	14	L
12	Cylinder Head Cover Plate Bolts	7.8	0.80	69 in·lb	

13. JT1500B7F Model
EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).
S: Follow the specific tightening sequence.
SS: Apply silicone sealant.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Side Camshaft Chain Guide Bolts (Upper)	25	2.5	18	
2	Exhaust Side Camshaft Chain Guide Bolts (Lower)	12	1.2	104 in·lb	
3	Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
4	Inlet Side Camshaft Chain Guide Bolt	12	1.2	104 in·lb	L
5	Camshaft Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	L
6	Camshaft Chain Tensioner Cap Bolt	20	2.0	14	
7	Camshaft Position Sensor Rotor Bolt	12	1.2	104 in·lb	L
8	Water Hose Joint	20	2.0	14	L
9	Oil Passage Joint	11	1.1	95 in·lb	L

10. Closed coil end faces downward.
11. A marking hollow faces exhaust side.

EO: Apply engine oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).
R: Replacement Parts
S: Follow the specific tightening sequence.

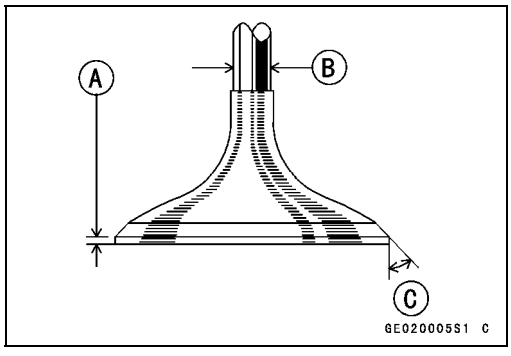
Specifications

Item	Standard	Service Limit
Camshafts		
Cam Height:		
Exhaust	35.442 ~ 35.556 mm (1.3954 ~ 1.3998 in.)	35.34 mm (1.391 in.)
Inlet	35.743 ~ 35.857 mm (1.4072 ~ 1.4117 in.)	35.64 mm (1.403 in.)
Camshaft Journal, Camshaft Cap Clearance	0.028 ~ 0.071 mm (0.0011 ~ 0.0028 in.)	0.16 mm (0.006 in.)
Camshaft Journal Diameter	23.950 ~ 23.972 mm (0.9429 ~ 0.9438 in.)	23.92 mm (0.942 in.)
Camshaft Bearing Inside Diameter	24.000 ~ 24.021 mm (0.9449 ~ 0.9457 in.)	24.08 mm (0.948 in.)
Camshaft Runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.1 mm (0.004 in.)
Cylinder Head		
Cylinder Compression	(usable range) 1 185~ 1 795 kPa (12.1 ~ 18.3 kgf/cm², 172 ~ 260 psi) @430 r/min. (rpm)	– – –
Cylinder Head Warp	– – –	0.05 mm (0.002 in.)
Valves		
Valve Clearance:		
Exhaust	0.32 ~ 0.41 mm (0.0126 ~ 0.0161 in.)	– – –
Inlet	0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)	– – –
Valve Head Thickness:		
Exhaust	0.8 mm (0.03 in.)	0.5 mm (0.02 in.)
Inlet	0.5 mm (0.02 in.)	0.25 mm (0.0098 in.)
Valve Stem Bend	TIR 0.01 mm (0.0004 in.) or less	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	4.955 ~ 4.970 mm (0.1951 ~ 0.1957 in.)	4.94 mm (0.194 in.)
Inlet	4.975 ~ 4.990 mm (0.1959 ~ 0.1965 in.)	4.96 mm (0.195 in.)
Valve Guide Inside Diameter:		
Exhaust	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.07 mm (0.200 in.)
Inlet	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.07 mm (0.200 in.)
Valve/valve Guide Clearance (Wobble Method):		
Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)	0.35 mm (0.014 in.)
Inlet	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)	0.29 mm (0.011 in.)
Valve Seat Cutting Angle	45°, 32°, 60°, 55°	– – –
Valve Seating Surface:		
Outside Diameter:		
Exhaust	27.6 ~ 27.8 mm (1.087 ~ 1.094 in.)	– – –
Inlet	32.6 ~ 32.8 mm (1.283 ~ 1.291 in.)	– – –
Width:		
Exhaust	0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)	– – –
Inlet	0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)	– – –
Valve Spring Free Length:		
Exhaust (Inner)	38.08 mm (1.499 in.)	36.7 mm (1.445 in.)
Exhaust (Outer)	45.97 mm (1.810 in.)	44.3 mm (1.744 in.)
Inlet (Inner)	37.97 mm (1.495 in.)	36.5 mm (1.437 in.)

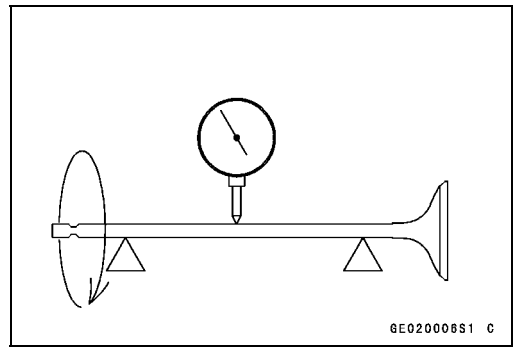
Specifications

Item	Standard	Service Limit
Inlet (Outer)	45.78 mm (1.802 in.)	44.2 mm (1.740 in.)
Cylinder, Piston		
Cylinder Inside Diameter	82.994 ~ 83.006 mm (3.2675 ~ 3.2679 in.)	83.10 mm (3.272 in.)
Piston Diameter	82.919 ~ 82.934 mm (3.2645 ~ 3.2651 in.)	82.77 mm (3.259 in.)
Piston/cylinder Clearance	0.060 ~ 0.087 mm (0.0024 ~ 0.0034 in.)	– – –
Piston Ring/groove Clearance:		
Top	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Second	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)	0.16 mm (0.0063 in.)
Piston Ring Groove Width:		
Top	0.92 ~ 0.94 mm (0.0362 ~ 0.0370 in.)	1.02 mm (0.0402 in.)
Second	1.01 ~ 1.03 mm (0.0398 ~ 0.0406 in.)	1.11 mm (0.0437 in.)
Piston Ring Thickness:		
Top	0.87 ~ 0.89 mm (0.0343 ~ 0.0350 in.)	0.80 mm (0.0315 in.)
Second	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.90 mm (0.0354 in.)
Piston Ring End Gap:		
Top	0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in.)	0.7 mm (0.0276 in.)
Second	0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)	0.8 mm (0.0315 in.)

Valve Head Thickness



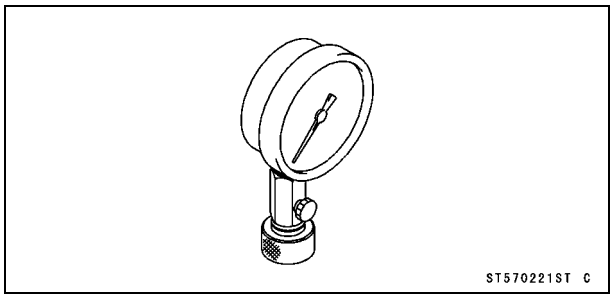
Valve Stem Bend



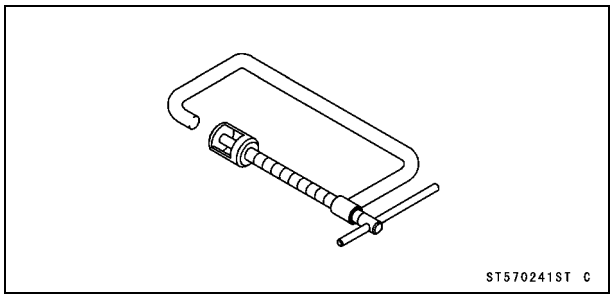
Valve Head Thickness [A]
Valve Stem Diameter [B]
45° [C]

Special Tools and Sealant

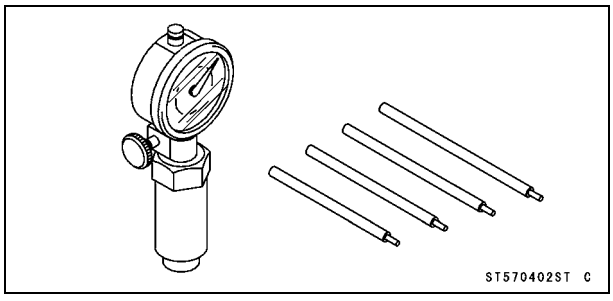
Compression Gauge, 20 kgf/cm²:
57001-221



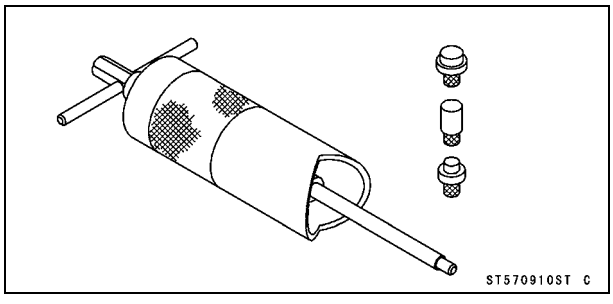
Valve Spring Compressor Assembly:
57001-241



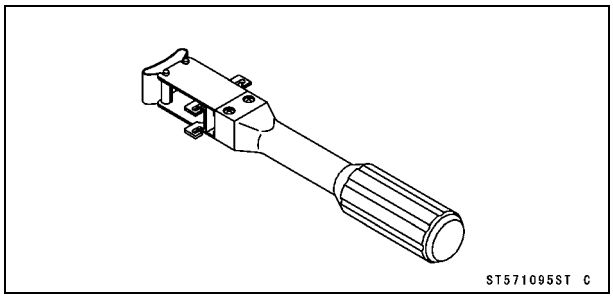
Top Dead Center Finder:
57001-402



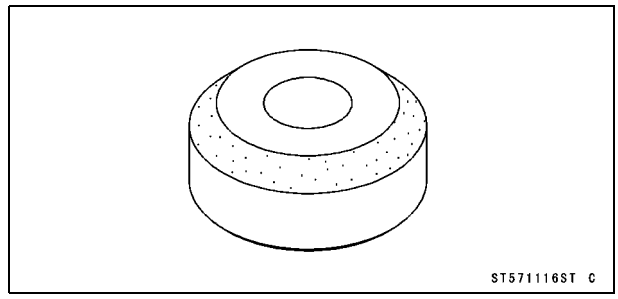
Piston Pin Puller Assembly:
57001-910



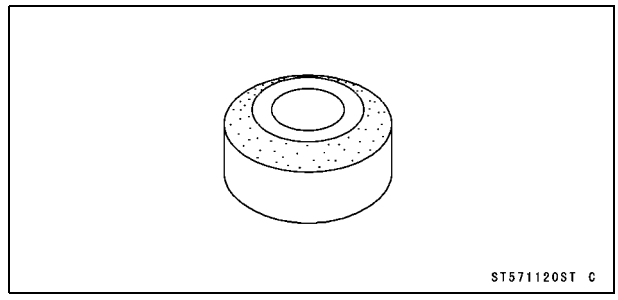
Piston Ring Compressor Grip:
57001-1095



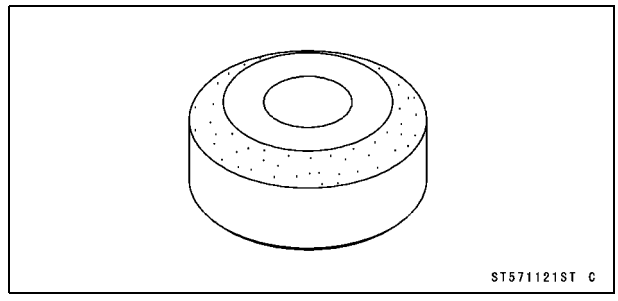
Valve Seat Cutter, 45° - ϕ35:
57001-1116



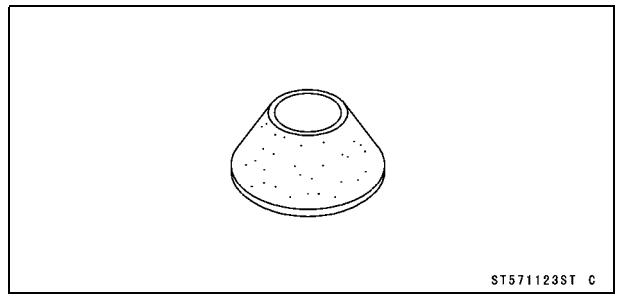
Valve Seat Cutter, 32° - ϕ30:
57001-1120



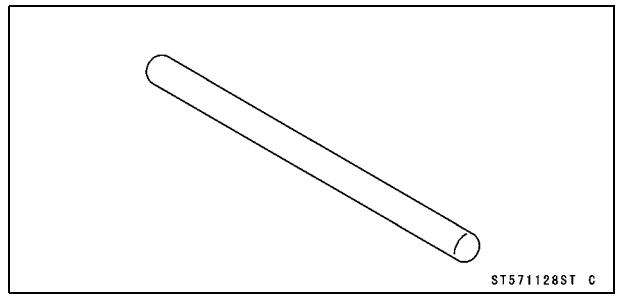
Valve Seat Cutter, 32° - ϕ35:
57001-1121



Valve Seat Cutter, 60° - ϕ30:
57001-1123

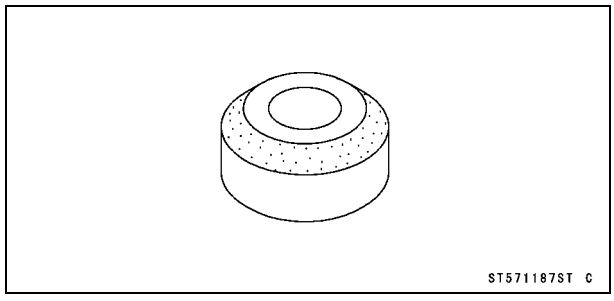


Valve Seat Cutter Holder Bar:
57001-1128

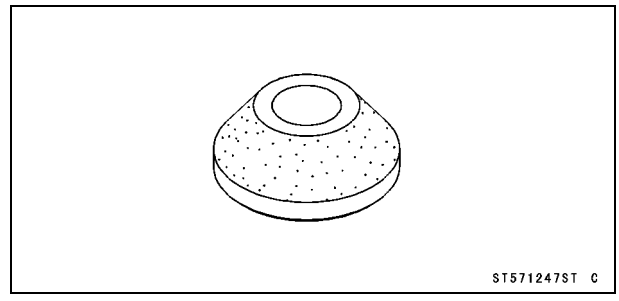


Special Tools and Sealant

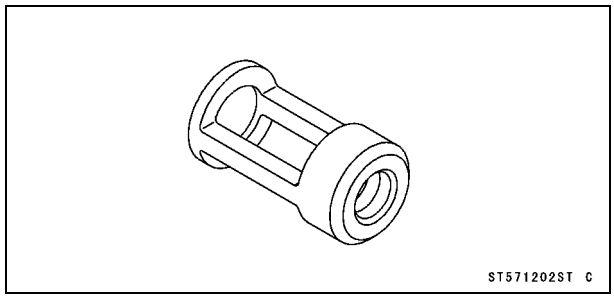
Valve Seat Cutter, 45° - ϕ30:
57001-1187



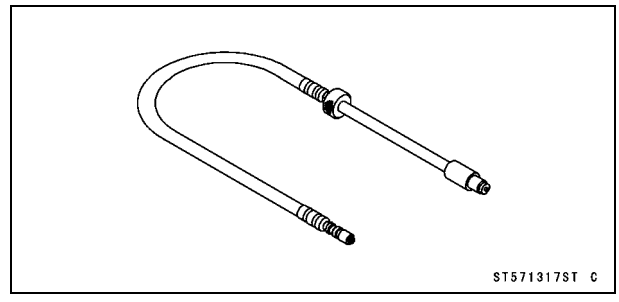
Valve Seat Cutter, 55° - ϕ35:
57001-1247



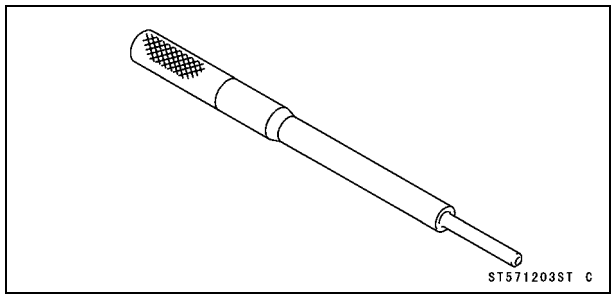
Valve Spring Compressor Adapter, ϕ22:
57001-1202



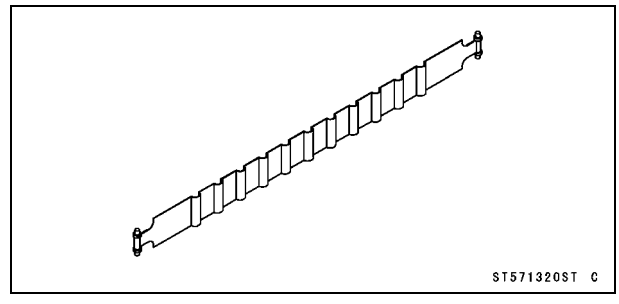
Compression Gauge Adapter, M10 × 1.0:
57001-1317



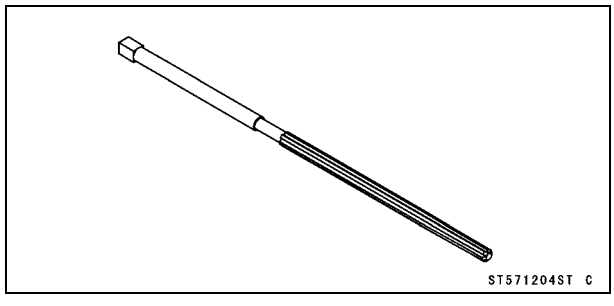
Valve Guide Arbor, ϕ5:
57001-1203



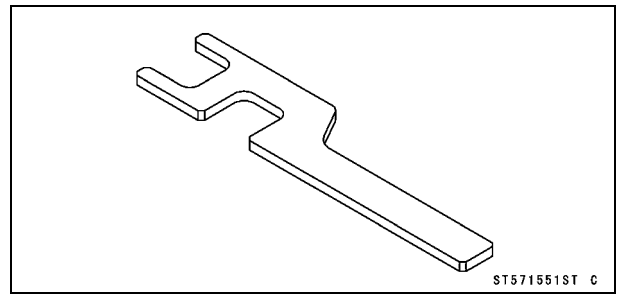
Piston Ring Compressor Belt, ϕ80 ~ ϕ91:
57001-1320



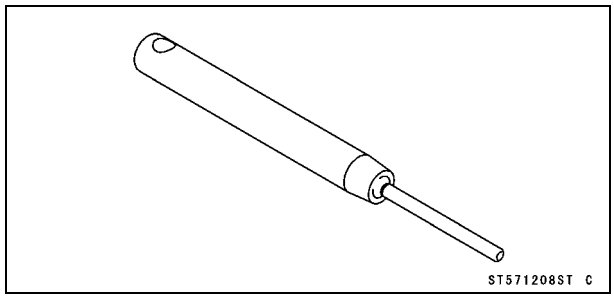
Valve Guide Reamer, ϕ5:
57001-1204



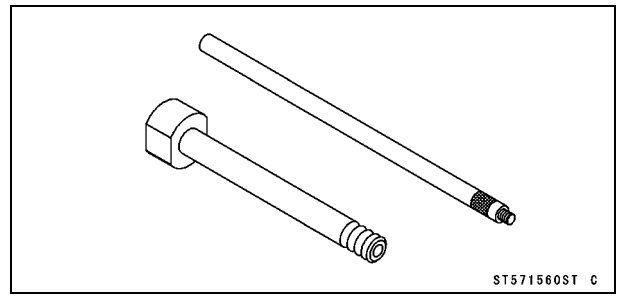
Shaft Wrench:
57001-1551



Valve Seat Cutter Holder, ϕ5:
57001-1208

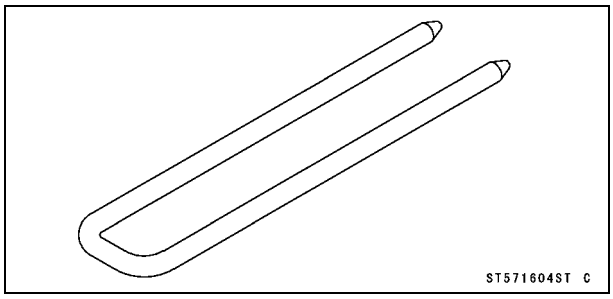


TDC Measurement Tool:
57001-1560

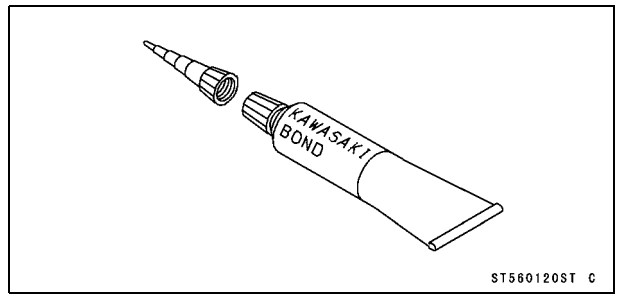


Special Tools and Sealant

Piston Base, ϕ8:
57001-1604



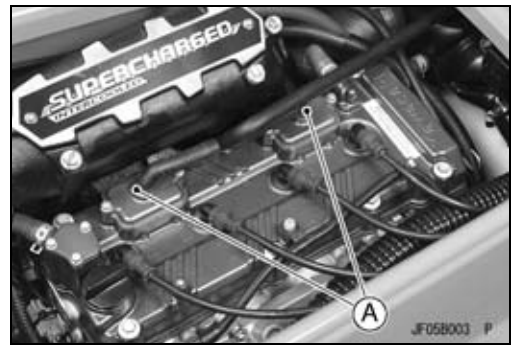
Kawasaki Bond (Silicone Sealant):
56019-120



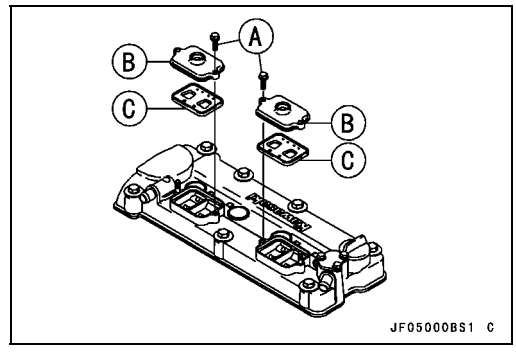
Clean Air System

Air Suction Valve Removal (JT1500B7F Model)

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Hoses [A]



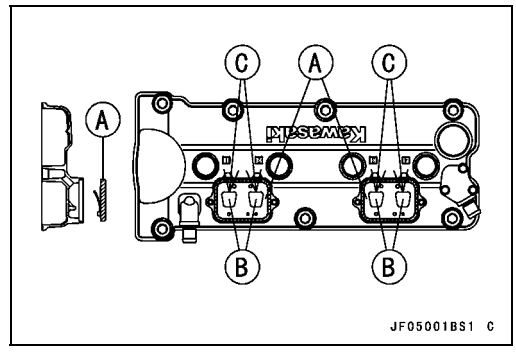
- Remove:
  Air Suction Valve Cover Bolts [A]
  Air Suction Valve Covers [B]
  Air Suction Valve Assembly [C]



Air Suction Valve Installation (JT1500B7F Model)

- Install the valve assembly [A] so that its reeds [B] side faces inside and it's opening [C] side faces inlet side.
- Install the air suction valve covers.

Torque - Air Suction Valve Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



Air Suction Valve Check (JT1500B7F Model)

- Refer to Air Suction Valve in the Periodic Maintenance chapter.

Clean Air System Hose Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the air filter housing, throttle body and air suction valve covers.

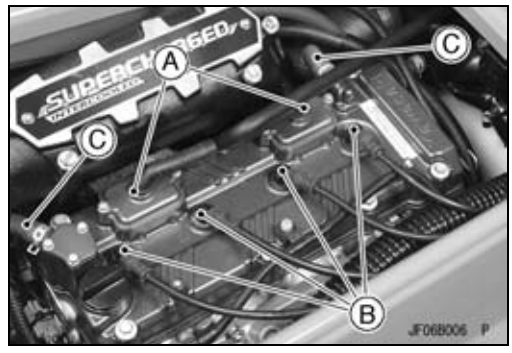
★If they are not, correct them. Replace them if they are damaged.

Cylinder Head Cover

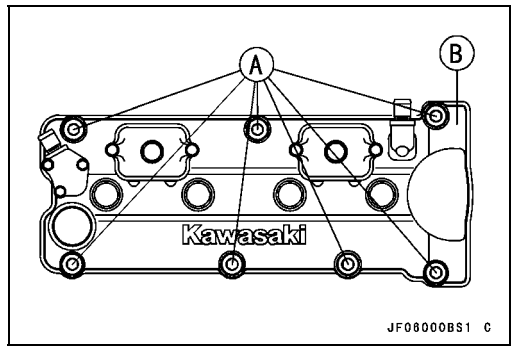
Cylinder Head Cover Removal

JT1500B7F Model

- Remove:
  Air Suction Valve Hoses [A]
  Spark Plug Caps [B]
  Breather Hoses [C]

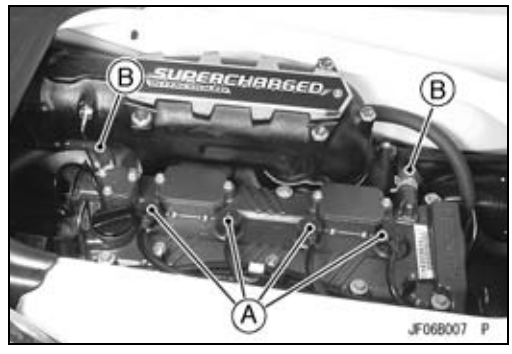


- Remove the cylinder head cover bolts [A] and take off the cover [B].

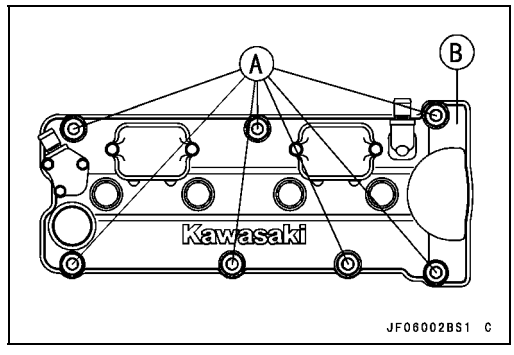


JT1500B8F Model

- Remove:
  Spark Plug Caps [A]
  Breather Hoses [B]

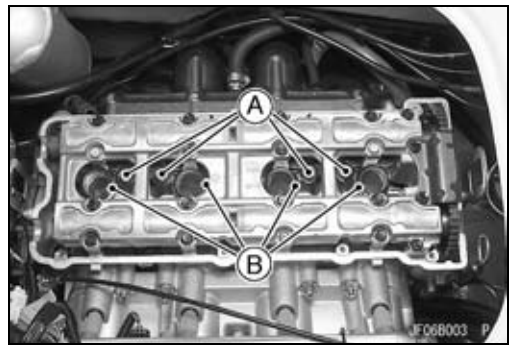


- Remove the cylinder head cover bolts [A] and take off the cover [B].



Cylinder Head Cover Installation

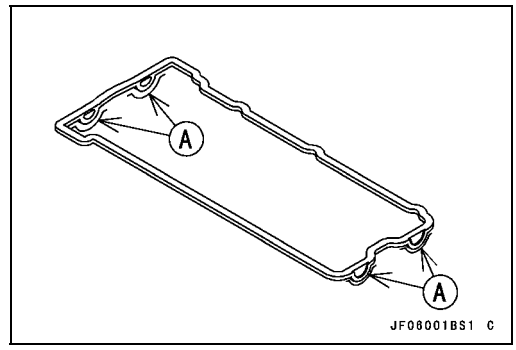
- Be sure to install the pins [A] and rubber gaskets [B].



Cylinder Head Cover

- Replace the head cover gasket with a new one if damaged.
- Apply silicone sealant [A] to the cylinder head cover gasket as shown.

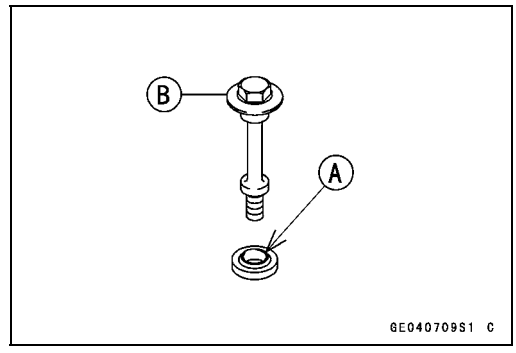
  Sealant - Kawasaki Bond (Silicone Sealant): 56019-120



- Install the washer with the metal side [A] faces upward.
- Tighten:

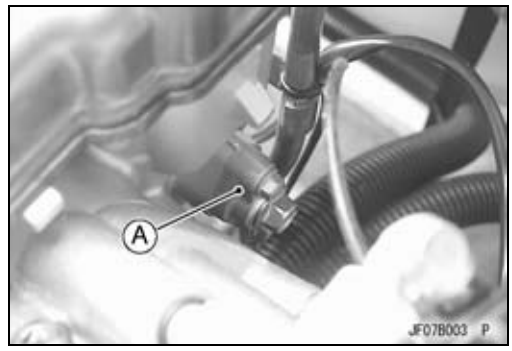
  Torque - Cylinder Head Cover Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Route the hoses correctly (see Appendix chapter).



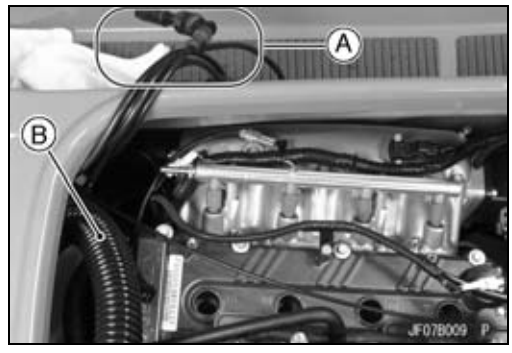
Camshaft Chain Tensioner

Camshaft Chain Tensioner Removal

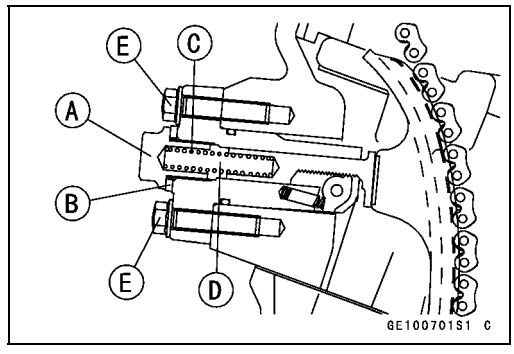


CAUTION

This is a non-return type camshaft chain tensioner [A]. The push rod does not return to its original position once it moves out to take up camshaft chain slack. Observe all the rules listed below:
When removing the tensioner, do not take out the mounting bolts only halfway. Retightening the mounting bolts from this position could damage the tensioner and the camshaft chain. Once the bolts are loosened, the tensioner must be removed and reset as described in "Camshaft Chain Tensioner installation."
Do not turn over the crankshaft while the tensioner is removed. This could upset the camshaft chain timing, and damage the valves.

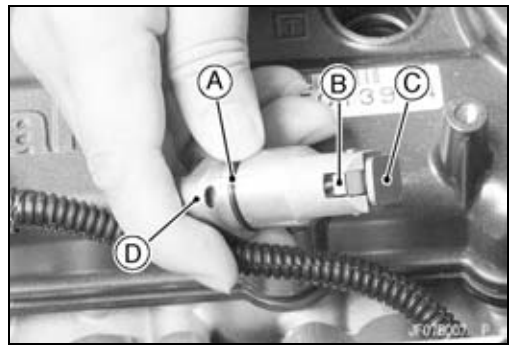


- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Pull off the spark plug caps and place the spark plug leads [A] out of the engine compartment.
- Disconnect:
  Fuel Hose (Delivery Pipe Side)
  Air Bypass Duct [B] (Air Box Side)



- Remove:
  Cap Bolt [A]
  Washer [B]
  Spring [C]
  Rod [D]
- Remove the mounting bolts [E] and take off the camshaft chain tensioner.

Camshaft Chain Tensioner Installation



- Apply grease to the O-ring [A].
- Release the stopper [B] and push the push rod [C] into the tensioner body [D] fully.
- Install the tensioner body so that the stopper faces downward.

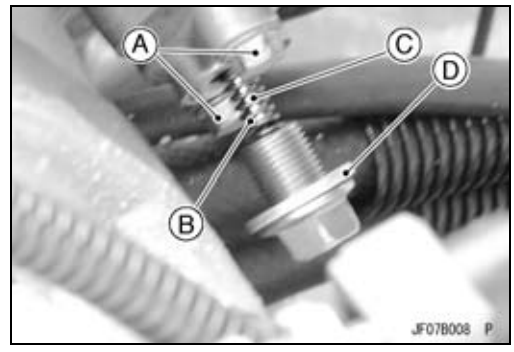
Camshaft Chain Tensioner

- Apply a non-permanent locking agent to the tensioner mounting bolts [A].
- Tighten the tensioner mounting bolts.

Torque - Camshaft Chain Tensioner Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Install the spring [B], rod [C] and washer [D].
- Tighten the cap bolt.

Torque - Camshaft Chain Tensioner Cap Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)



Camshaft, Camshaft Chain

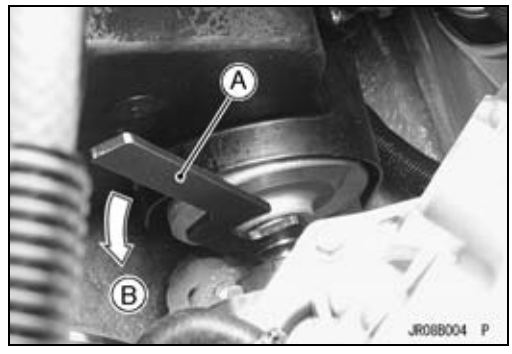
Camshaft Removal

- Remove:
  Seat (see Hull/Engine Hood chapter)
  Spark Plugs (see Periodic Maintenance chapter)
  Cylinder Head Cover (see Cylinder Head Cover Removal)
  Air Filter (see Fuel System (DFI) chapter)

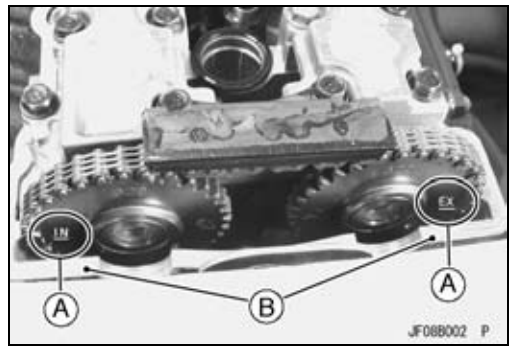
- Position the crankshaft at #1, #4 piston TDC as follows.

○Using the shaft wrench [A], turn the crankshaft counterclockwise [B] and set the crankshaft at #1, 4 piston TDC.

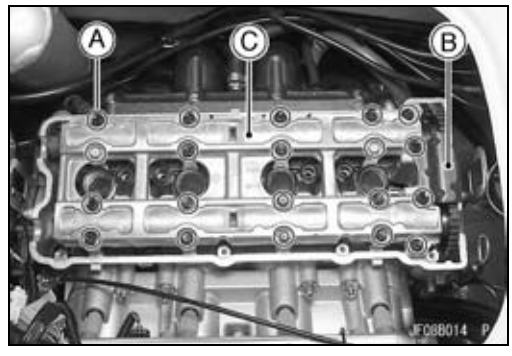
Special Tool - Shaft Wrench: 57001-1551



○The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown.



- Remove:
  Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
  Camshaft Cap Bolts [A]
  Upper Camshaft Chain Guide [B]
  Camshaft Cap [C]
  Camshafts
- Stuff a clean cloth into the chain tunnel to keep any parts from dropping into the crankcase.



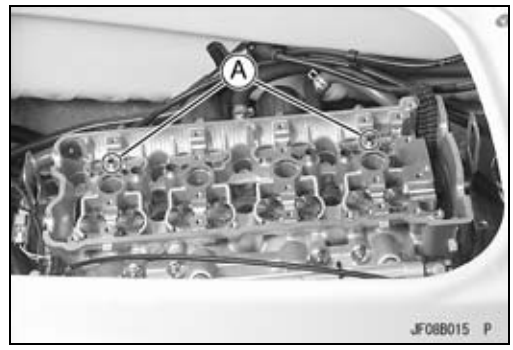
CAUTION

The crankshaft may be turned while the camshafts are removed. Always pull the chain taut while turning the crankshaft. This avoids kinking the chain on the lower (crankshaft) sprocket. A kinked chain could damage both the chain and the sprocket.

Camshaft, Camshaft Chain

Camshaft Installation

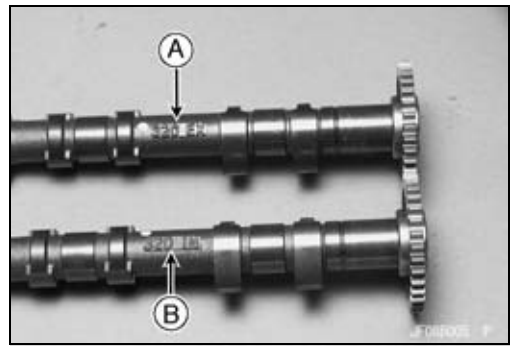
● Be sure to install the following parts.
Pins [A]



● Apply molybdenum disulfide oil solution to all cam parts and journals.

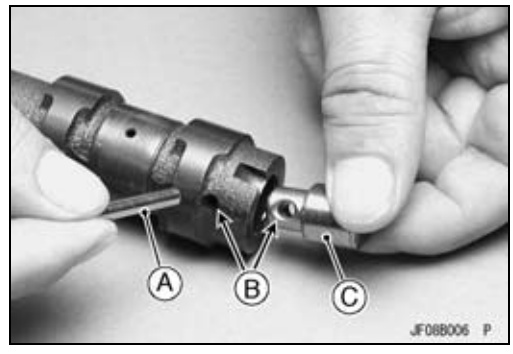
NOTE

○*The exhaust camshaft has a 320 EX mark [A] and the inlet camshaft has a 320 IN mark [B]. Be careful not to mix up these shafts.*



★If the camshaft position sensor rotor is removed, install it as follows.

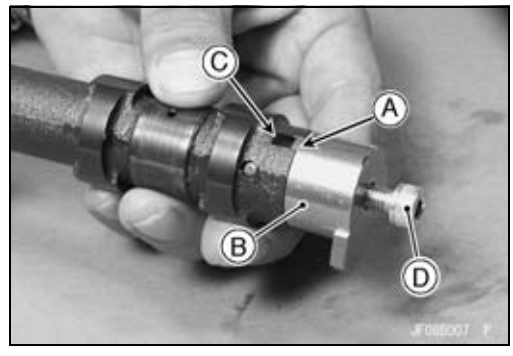
○Insert the pin [A] into the holes [B] in the camshaft and boss [C].



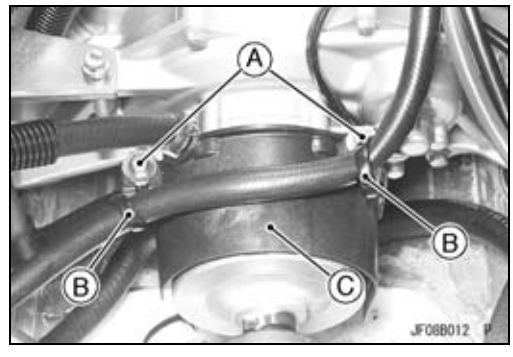
○Fit the projection [A] of the rotor [B] on the camshaft recess [C].

○Apply a non-permanent locking agent to the camshaft position sensor rotor bolt [D], and tighten it.

Torque - Camshaft Position Sensor Rotor Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)



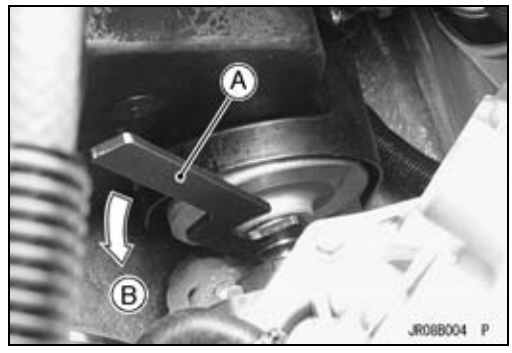
● Remove:
Coupling Cover Bolts [A]
Clamps [B]
Coupling Cover [C]



Camshaft, Camshaft Chain

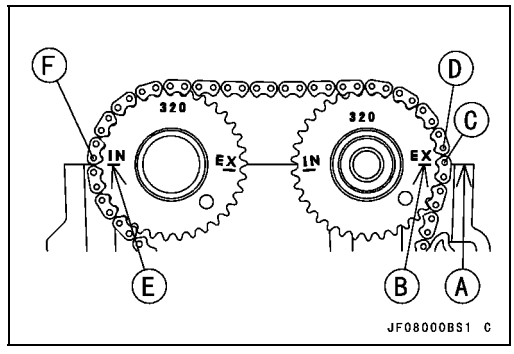
- Remove the spark plugs.
- Using the shaft wrench [A], turn the crankshaft counterclockwise [B] and set the crankshaft at #1, 4 piston TDC (see Piston TDC Finding).

Special Tool - Shaft Wrench: 57001-1551



- Pull the tension side (exhaust side) of the chain taut to install the chain.
- Engage the camshaft chain with the camshaft sprockets so that the timing marks on the sprockets are positioned as shown.

○The timing marks must be aligned with the cylinder head upper surface [A].
EX mark [B]
#1 Pin [C]
#2 Pin [D]
IN mark [E]
#31 Pin [F]

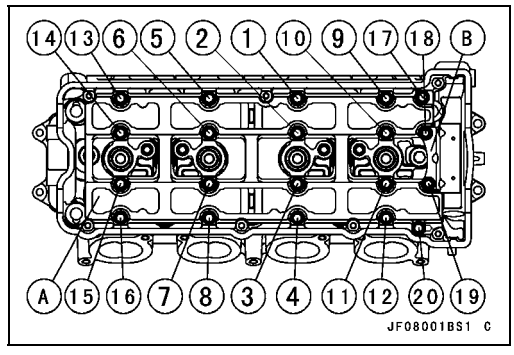


- Install the camshaft cap [A] and upper camshaft chain guide [B]. While pushing the camshaft chain, tighten all camshaft bolts and chain guide bolts.

○Install the longer (white) bolts to the #10 and #14 position shown by triangle marks.

○First tighten the all camshaft cap and chain guide bolts evenly to seat the camshaft in place, then tighten all bolts following the specified tightening sequence.

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)
Upper Camshaft Chain Guide Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)



- Tighten the camshaft chain tensioner (see Camshaft Chain Tensioner installation).

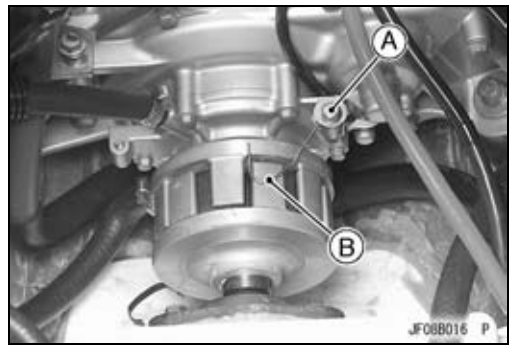
○Turn the crankshaft counterclockwise two turns.

- Install the cylinder head cover (see Cylinder Head Cover installation).

Piston TDC Finding

This job can be done when the engine is on the hull and during camshaft installation.

- Prepare a suitable wire for pointer.
- Using the coupler cover bolt [A], hold the wire pointer [B].

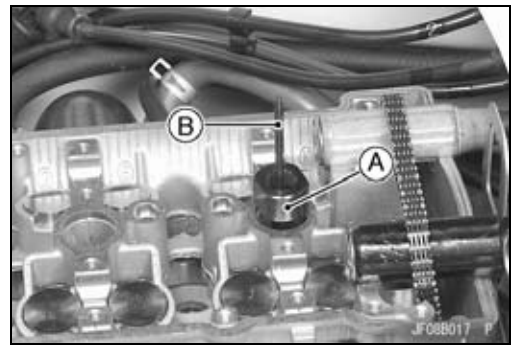


Camshaft, Camshaft Chain

- Remove:
  #1 Spark Plug (Front Side)
- Install the piston top detector [A] in the hole of the plug.

  Special Tool - TDC Measurement Tool: 57001-1560
- Insert the gauge extender [B] into the detector.
- Using the shaft wrench, turn the crankshaft until the gauge extender reaches its highest point.

  Special Tool - Shaft Wrench: 57001-1551
- Remove the extender and install it to the gauge.

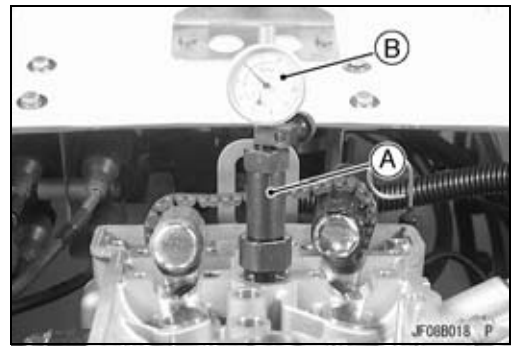


- Install the top dead center finder [A] and the gauge [B] with the extender.

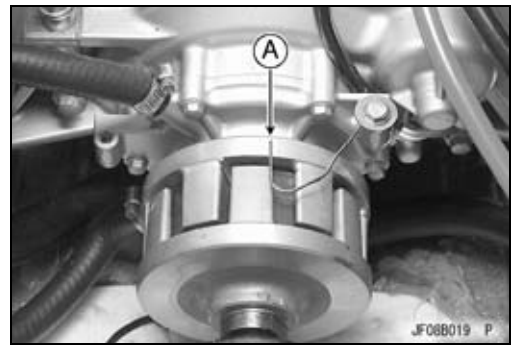
  Special Tool - Top Dead Center Finder: 57001-402

○Set the gauge at position that the needle on the gauge rotates a few turns.

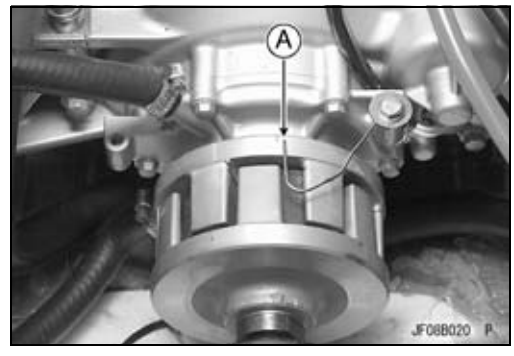
- Set the gauge to read “0”.



- Turn the crankshaft counterclockwise until the needle will stop fluctuating, then scribe a mark [A] on the coupling at the tip of the wire pointer.

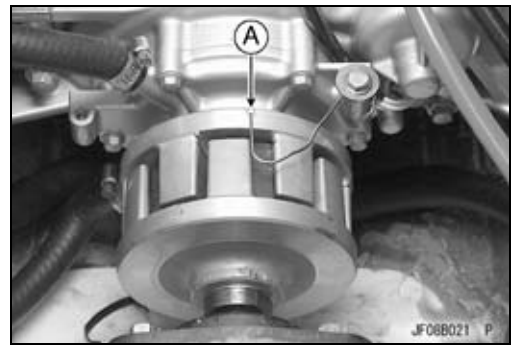


- Turn the crankshaft clockwise until the needle will stop fluctuating, then describe a mark [A] on the coupling at the tip of the wire pointer.



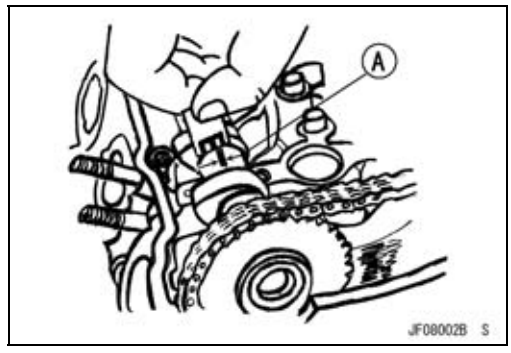
- Turn the crankshaft so that the wire pointer is halfway [A] between the two described marks.

○The crankshaft is now at TDC for #1 and #4 Cylinders.



Camshaft, Camshaft Chain

Camshaft, Camshaft Cap Wear



- Cut strips of plastigage (press gauge) to journal width. Place a strip on each journal parallel to the camshaft installed in the correct position.
- Measure each clearance between the camshaft journal and the camshaft cap using plastigage [A].
- Tighten:

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)
Upper Camshaft Chain Guide Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

NOTE

○*Do not turn the camshaft when the plastigage is between the journal and camshaft cap.*

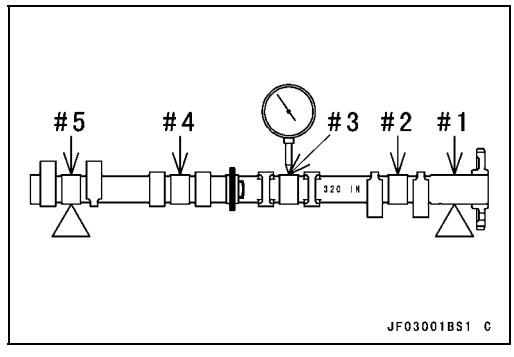
Camshaft Journal, Camshaft Cap Clearance
Standard: 0.028 ~ 0.071 mm (0.0011 ~ 0.0028 in.)
Service Limit: 0.16 mm (0.006 in.)

★If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

Camshaft Journal Diameter
Standard: 23.950 ~ 23.972 mm (0.9429 ~ 0.9438 in.)
Service Limit: 23.92 mm (0.942 in.)

★If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again
★If the clearance still remains out of the limit, replace the cylinder head with camshaft cap.

Camshaft Runout

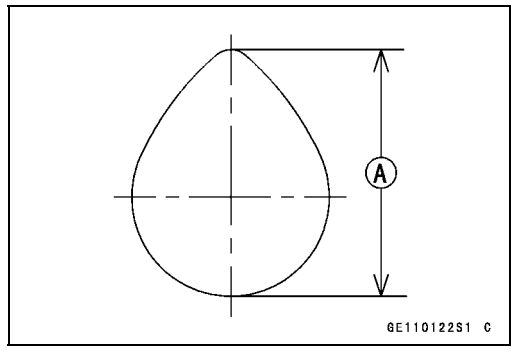


- Remove the camshaft (see Camshaft Removal).
- Set the camshaft on V blocks.
- Measure runout with a dial gauge at the specified place as shown.

★If the runout exceeds the service limit, replace the camshaft.

Camshaft Runout
Standard: TIR 0.02 mm (0.0008 in.) or less
Service Limit: TIR 0.1 mm (0.004 in.)

Cam Wear



- Remove the camshaft (see Camshaft Removal).
- Measure the height [A] of each cam with a micrometer.

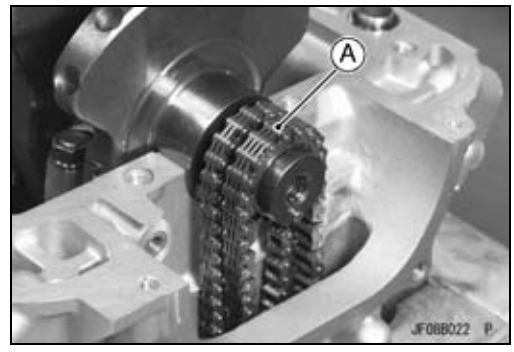
★If the cams are worn down past the service limit, replace the camshaft.

Cam Height
Standard:
Exhaust 35.442 ~ 35.556 mm (1.3954 ~ 1.3998 in.)
Inlet 35.743 ~ 35.857 mm (1.4072 ~ 1.4117 in.)
Service Limit:
Exhaust 35.34 mm (1.391 in.)
Inlet 35.64 mm (1.403 in.)

Camshaft, Camshaft Chain

Camshaft Chain Removal

- Split the crankcase (see Engine Bottom End chapter).
- Remove the camshaft chain [A] from the crankshaft sprocket.



Cylinder Head

Cylinder Compression Measurement

NOTE

○*Use the battery which is fully charged.*

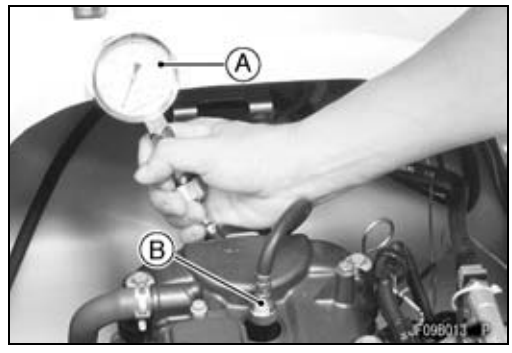
- Thoroughly warm up the engine, while checking that there is no compression leakage from around the spark plugs or the cylinder head gasket.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damaged will occur.

- Stop the engine.
- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect both two connection on the ignition coil primary lead connectors.
- Remove:
  Spark Plugs (see Periodic Maintenance chapter)

- Attach the compression gauge [A] and adapter [B] firmly into the spark plug hole.
- Using the starter motor, turn the engine with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.



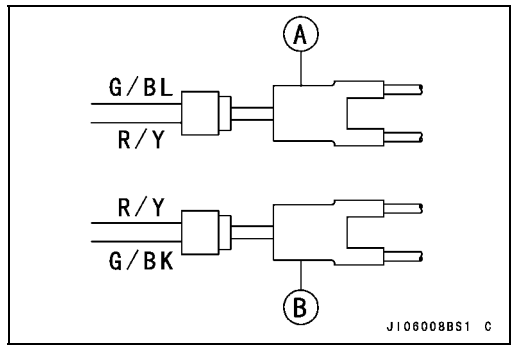
Special Tools - Compression Gauge, 20 kgf/cm²: 57001-221
Compression Gauge Adapter, M10 × 1.0: 57001-1317

Cylinder Compression
Usable Range: 1 185 ~ 1 795 kPa (12.1 ~ 18.3 kgf/cm², 172 ~ 260 psi) @430 r/min (rpm)

- Repeat the measurement for the other cylinders.
- Install the spark plugs (see Periodic Maintenance chapter).

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)

- Reconnect the primary ignition coil lead connectors, noting the #1,#4 [A] and the #2, #3 [B] coil connectors. the #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.



NOTE

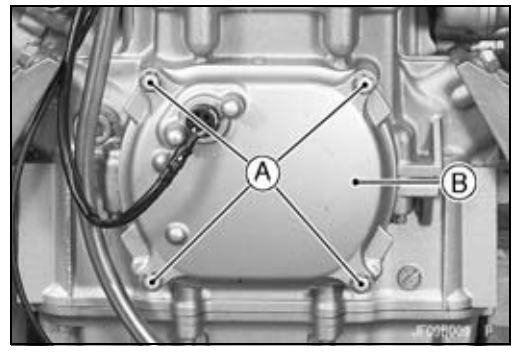
○*The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).*

Cylinder Head

The following table should be consulted if the obtainable compression reading is not within the usable range.

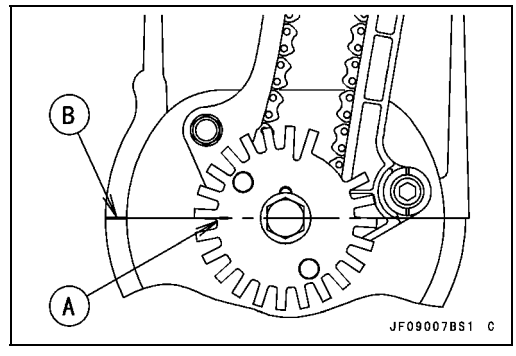
Problem	Diagnosis	Remedy (Action)
Cylinder compression is higher than usable range	Carbon accumulation on piston and in combustion chamber possibly due to damaged valve stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	incorrect cylinder head gasket thickness.	Replace the gasket with a standard part.
Cylinder compression is lower than usable range	Gas leakage around cylinder head	Replace damaged gasket and check cylinder head warp.
	Bad condition of valve seating	Repair if necessary.
	incorrect valve clearance	Adjust the valve clearance.
	incorrect piston/cylinder clearance	Replace the piston and/or cylinder
	Piston seizure	Inspect the cylinder and replace/repair the cylinder and/or piston as necessary.
	Bad condition of piston ring and/or piston ring grooves	Replace the piston and/or the piston rings.

Cylinder Head Removal



- Remove:
  Engine (see Engine Removal/Installation chapter)
  Cylinder Head Cover (see Cylinder Head Cover Removal)
- Unscrew the crankshaft sensor cover bolts [A] and remove the crankshaft sensor cover [B].

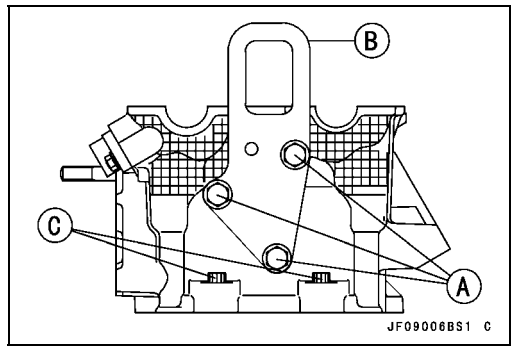
○Drain the engine oil by one liter.



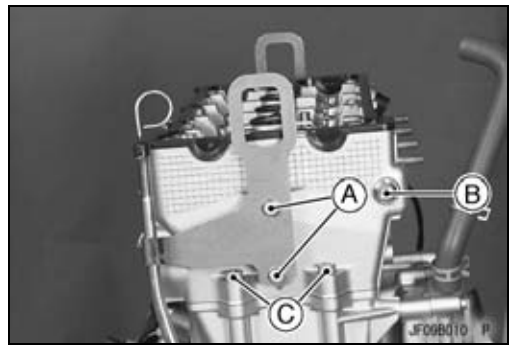
- Turn the crankshaft clockwise and set the crankshaft at #1, 4 piston TDC.
  TDC Mark [A] for #1, 4 pistons
  Timing Mark [B] (Crankcase halves mating surface)
- Remove:
  Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
  Camshafts (see Camshaft Removal)

Cylinder Head

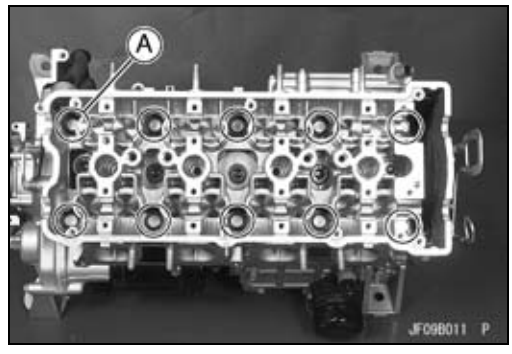
● Remove:
Engine Hook Bolts [A]
Engine Hook [B]
Cylinder Head Bolts [C]



● Remove:
Upper Dipstick Tube Bolts [A]
Upper Exhaust Side Camshaft Chain Guide Bolt [B]
M7 Cylinder Head Bolts [C]



● Remove the M11 cylinder head bolts [A] and washers.
● Take off the cylinder head.

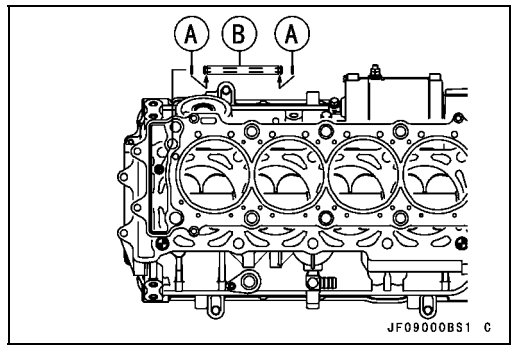


Cylinder Head Installation

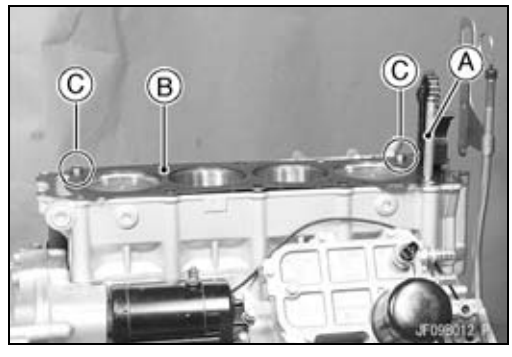
NOTE

○*The camshaft cap is machined with the cylinder head, so if a new cylinder head is installed, use the cap that is supplied with the new head.*

● Replace that the O-rings [A] of the oil pipe [B] and apply molybdenum disulfide oil solution to them.

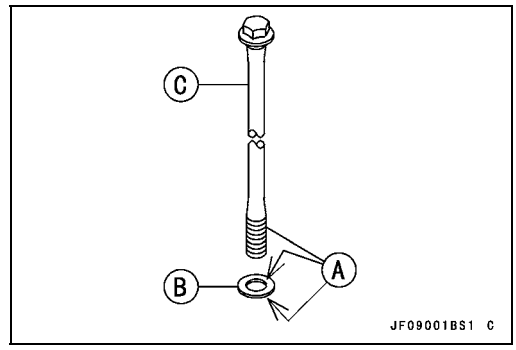


● Verify that the oil pipe [A] is installed properly.
● Install a new cylinder head gasket [B], and knock pins [C].



Cylinder Head

- Apply molybdenum disulfide oil solution [A] to both sides of the M11 cylinder head bolt washers [B] and the thread of head bolts [C].



- Install the cylinder head.
- First, tighten the M11 cylinder head bolts following the tightening sequence [1 ~ 10].

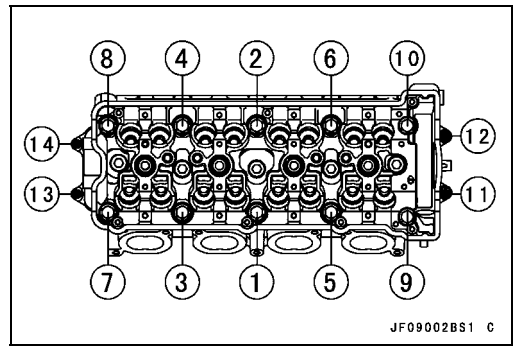
Torque - Cylinder Head Bolts (M11):
First: 23 N·m (2.3 kgf·m, 17 ft·lb)
Final: 69 N·m (7.0 kgf·m, 51 ft·lb)

- Next, tighten the M7 cylinder head bolts following the tightening sequence [11 ~ 12].

Torque - Cylinder Head Bolts (M7): 20 N·m (2.0 kgf·m, 14 ft·lb)

- Lastly, tighten the M6 cylinder head bolts following the tightening sequence [13 ~ 14].

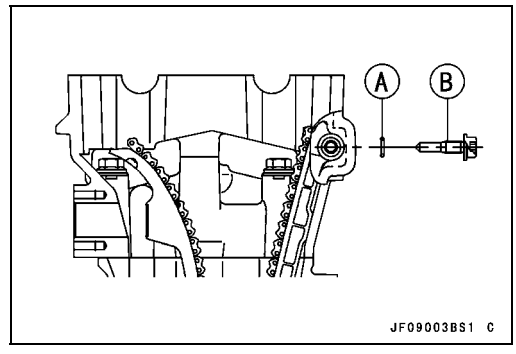
Torque - Cylinder Head Bolts (M6): 12 N·m (1.2 kgf·m, 104 in·lb)



- Apply grease to the O-ring [A].
- Install:
  O-ring
  Upper Exhaust Side Camshaft Chain Guide Bolt [B]
- Tighten:

Torque - Exhaust Side Camshaft Chain Guide Bolt (Upper): 25 N·m (2.5 kgf·m, 18 ft·lb)

- Install the camshafts (see Camshaft Installation).



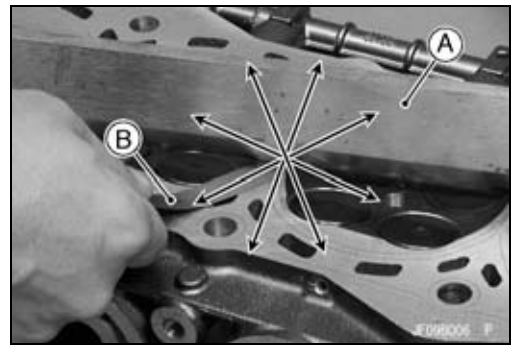
Cylinder Head Warp

- Remove the cylinder head (see Cylinder Head Removal).
- Clean the cylinder head.
- Lay a straightedge across the lower surface of the cylinder head at several positions.
- Measure the space between the straightedge [A] and the head with a thickness gauge [B].

Cylinder Head Warp
Standard: – – –
Service Limit: 0.05 mm (0.002 in.)

★If the cylinder head is warped more than the service limit, replace it.

★If the cylinder head is warped less than the service limit, repair the head by rubbing the lower surface on emery paper secured to a surface plate (first No. 200, then No. 400).



Valves

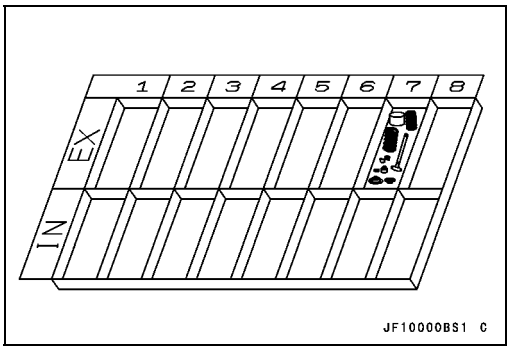
Valve Clearance Check

- Refer to Valve Clearance Inspection and Adjustment in the Periodic Maintenance chapter.

Valve Removal

- Remove the cylinder head (see Cylinder Head Removal).
- Remove the valve lifter and shim.

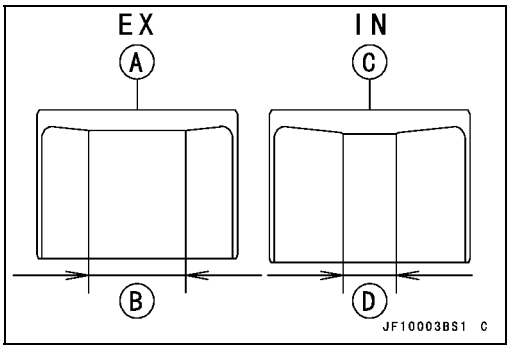
○Mark and record the valve lifter and shim locations so they can be installed in their original positions.



NOTE

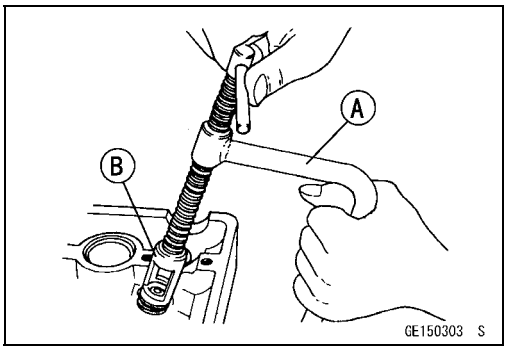
○*For the EX valve lifters, JT1500B has larger size boss.*

EX Valve Lifters [A]: Boss diameter is larger [B]
IN Valve Lifters [C]: Boss diameter is smaller [D]



- Using the valve spring compressor assembly, remove the valve.

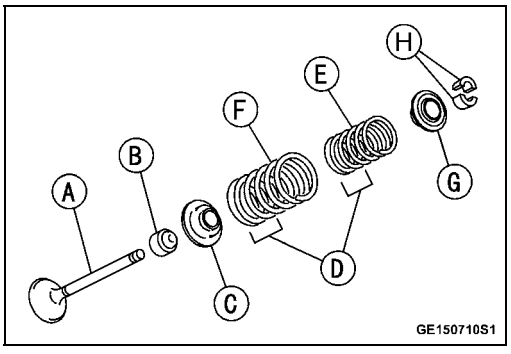
Special Tools - Valve Spring Compressor Assembly: 57001 -241 [A]
Valve Spring Compressor Adapter, ϕ22: 57001-1202 [B]



Valve Installation

- Replace the oil seal with a new one.
- Apply thin coat of molybdenum disulfide grease to the valve stem before valve installation.
- Install the springs so that the closed coil end faces downwards.

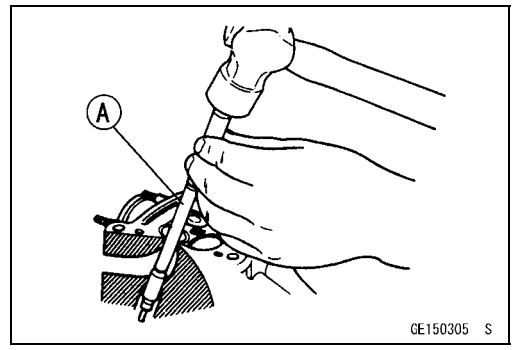
Valve Spring Paint Color: EX-Red
IN-Blue



[A] Valve Stem
[B] Oil Seal
[C] Spring Seat
[D] Closed Coil End
[E] Valve Springs (Inner)
[F] Valve Springs (Outer)
[G] Retainer
[H] Split Keepers

Valves

Valve Guide Removal



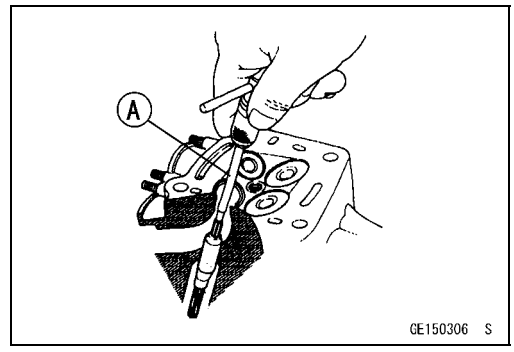
- Remove:
  Valve (see Valve Removal)
  Oil Seal
  Spring Seat
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302°F), and hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

CAUTION

Do not heat the cylinder head with a torch. This will warp the cylinder head. Soak the cylinder head in oil and heat the oil.

Special Tool - Valve Guide Arbor, ϕ5: 57001-1203

Valve Guide Installation



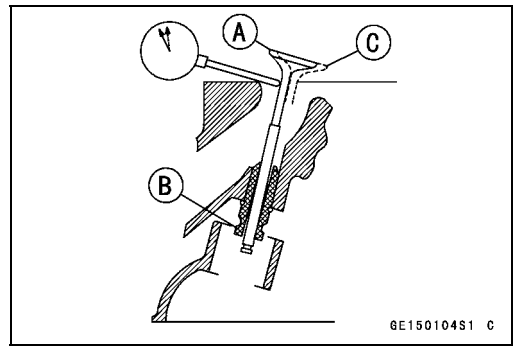
- Apply engine oil to the valve guide outer surface before installation.
- Heat the area around the valve guide hole to about 120 ~ 150°C (248 ~ 302°F).
- Drive the valve guide in from the top of the head using the valve guide arbor. The flange stops the guide from going in too far.

Special Tool - Valve Guide Arbor, ϕ5: 57001-1203

- Ream the valve guide with valve guide reamer [A] even if the old guide is reused.

Special Tool - Valve Guide Reamer, ϕ5: 57001-1204

Valve-to-Guide Clearance Measurement (Wobble Method)



If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method as indicated below.

- Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
- Move the stem back and forth [C] to measure valve/valve guide clearance.
- Repeat the measurement in a direction at a right angle to the first.

★If the reading exceeds the service limit, replace the guide.

NOTE

○*The reading is not actual valve/valve guide clearance because the measuring point is above the guide.*

Valve/Valve Guide Clearance (Wobble Method)

Standard:

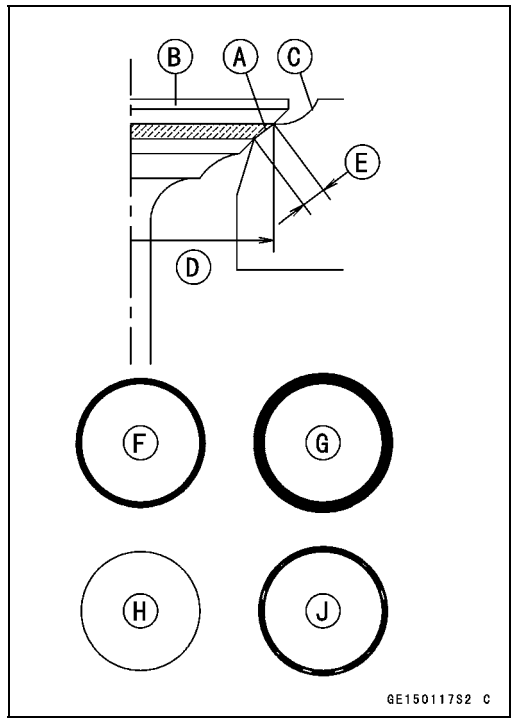
Exhaust	**0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)**
Inlet	**0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)**

Service Limit:

Exhaust	**0.35 mm (0.014 in.)**
Inlet	**0.29 mm (0.011 in.)**

Valves

Valve Seat Inspection



- Remove the valve (see Valve Removal).
- Check the valve seating surface [A] between the valve [B] and valve seat [C].

○Measure the outside diameter [D] of the seating pattern on the valve seat.

★If the outside diameter is too large or too small, repair the seat (see Valve Seat Repair).

Valve Seating Surface Outside Diameter
Standard:

Exhaust	**27.6 ~ 27.8 mm (1.087 ~ 1.094 in.)**
Inlet	**32.6 ~ 32.8 mm (1.283 ~ 1.291 in.)**

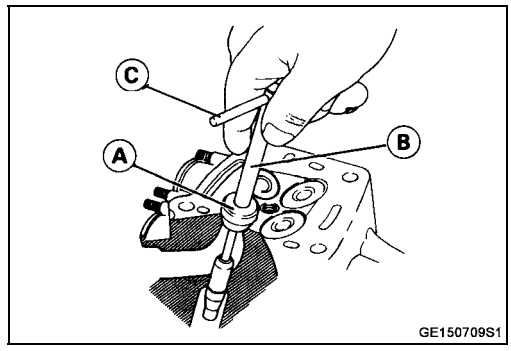
○Measure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with a vernier caliper.
Good [F]

★If the width is too wide [G], too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).

Valve Seating Surface Width
Standard:

Exhaust	**0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)**
Inlet	**0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)**

Valve Seat Repair



- Repair the valve seat with the valve seat cutters [A].

Special Tools- **Valve Seat Cutter Holder, ϕ5: 57001-1208 [B]**

Valve Seat Cutter Holder Bar: 57001-1128 [C]

[For Inlet Valve Seat]

Valve Seat Cutter, 45° - ϕ35: 57001-1116

Valve Seat Cutter, 32° - ϕ35: 57001-1121

Valve Seat Cutter, 55° - ϕ35: 57001-1247

[For Exhaust Valve Seat]

Valve Seat Cutter, 45° - ϕ30: 57001-1187

Valve Seat Cutter, 32° - ϕ30: 57001-1120

Valve Seat Cutter, 60° - ϕ30: 57001-1123

★If the manufacturer's instructions are not available, use the following procedure.

Valves

Seat Cutter Operation Care

1. This valve seat cutter is developed to grind the valve for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

NOTE

○*Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.*

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

○*Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.*

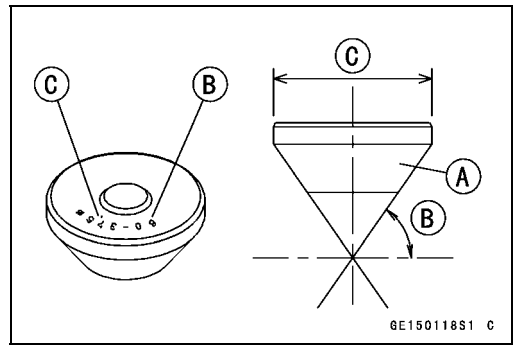
5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter

The marks stamped on the back of the cutter [A] represent the following.

60° ..... Cutter angle [B]

37.5ϕ ..... Outer diameter of cutter [C]



Operating Procedures

- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

CAUTION

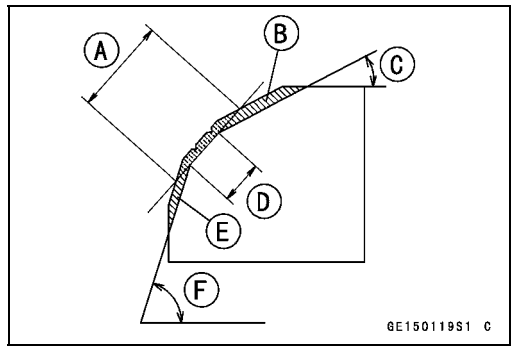
Do not grind the seat too much. Overgrinding will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced.

Valves

● Measure the outside diameter of the seating surface with a vernier caliper.

★If the outside diameter of the seating surface is too small, repeat the 45° grind until the diameter is within the specified range.

Widened Width [A] of engagement by machining with 45° cutter
Ground Volume [B] by 32° cutter
32° [C]
Correct Width [D]
Ground Volume [E] by 60° or 55° cutter
60° or 55° [F]



● Measure the outside diameter of the seating surface with a vernier caliper.

★If the outside diameter of the seating surface is too small, repeat the 45° grind [A] until the diameter is within the specified range.

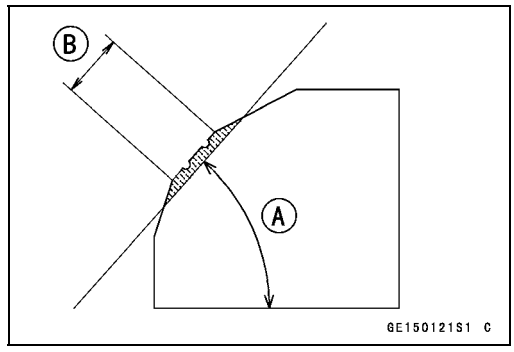
Original Seating Surface [B]

NOTE

○*Remove all pittings of flaws from 45° ground surface.*

○*After grinding with 45° cutter, apply thin coat of machinist's dye to seating surface. This makes seating surface distinct and 32° and 60° grinding operation easier.*

○*When the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.*



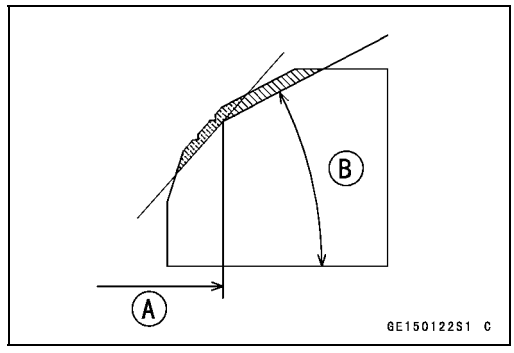
★If the outside diameter [A] of the seating surface is too large, make the 32° grind described below.

★If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.

● Grind the seat at a 32° angle [B] until the seat O.D. is within the specified range.

○To make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.

○Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.



CAUTION

The 32° cutter removes material very quickly. Check the seat outside diameter frequently to prevent overgrinding.

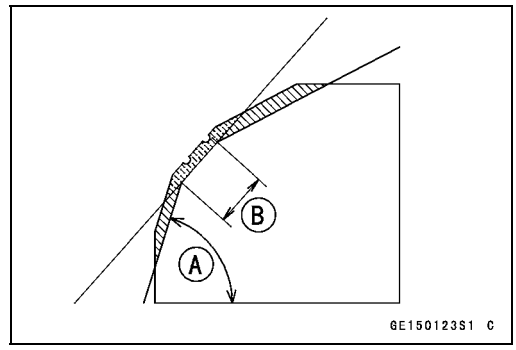
○After making the 32° grind, return to the seat O.D. measurement step above.

● To measure the seat width, use a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.

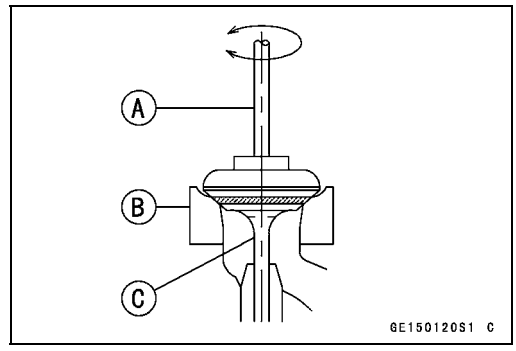
★If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat O.D. measurement step above.

Valves

★If the seat width is too wide, make the 60° or 55° [A] grind described below.
★If the seat width is within the specified range, lap the valve to the seat as described below.
● Grind the seat at a 60° or 55° angle until the seat width is within the specified range.
○To make the 60° or 55° grind, fit 60° or 55° cutter into the holder, and slide it into the valve guide.
○Turn the holder, while pressing down lightly.
○After making the 60° or 55° grind, return to the seat width measurement step above.
Correct Width [B]

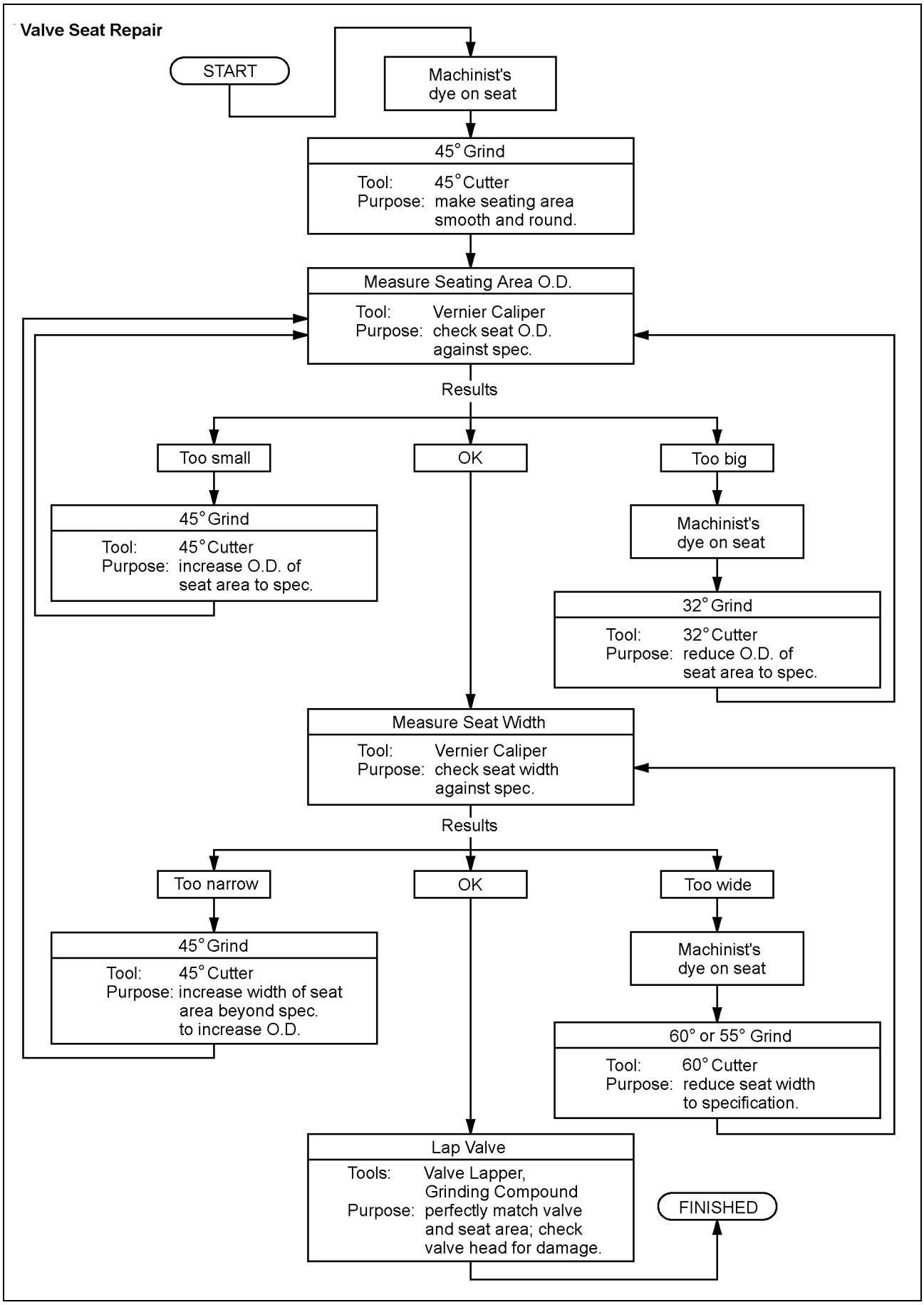


● Lap the valve to the seat, once the seat width and O.D. are within the ranges specified above.
○Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
○Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
○Repeat the process with a fine grinding compound.
[A] Lapper
[B] Valve Seat
[C] Valve



● The seating area should be marked about in the middle of the valve face.
★If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
● Be sure to remove all grinding compound before assembly.
● When the engine is assembled, be sure to adjust the valve clearance (see Valve Clearance Adjustment section of Periodic Maintenance chapter).

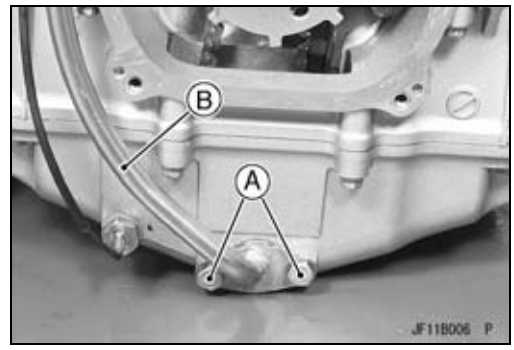
Valves


Valve Seat Repair
START
Machinist's dye on seat
45° Grind
Tool: 45° Cutter
Purpose: make seating area smooth and round.
Measure Seating Area O.D.
Tool: Vernier Caliper
Purpose: check seat O.D. against spec.
Results
Too small
OK
Too big
45° Grind
Tool: 45° Cutter
Purpose: increase O.D. of seat area to spec.
Machinist's dye on seat
32° Grind
Tool: 32° Cutter
Purpose: reduce O.D. of seat area to spec.
Measure Seat Width
Tool: Vernier Caliper
Purpose: check seat width against spec.
Results
Too narrow
OK
Too wide
45° Grind
Tool: 45° Cutter
Purpose: increase width of seat area beyond spec. to increase O.D.
Machinist's dye on seat
60° or 55° Grind
Tool: 60° Cutter
Purpose: reduce seat width to specification.
Lap Valve
Tools: Valve Lapper, Grinding Compound
Purpose: perfectly match valve and seat area; check valve head for damage.
FINISHED

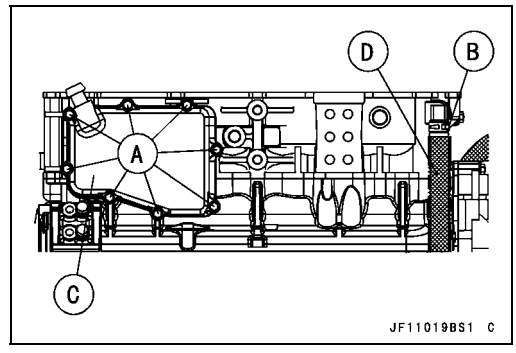
Cylinder, Pistons

Cylinder Removal

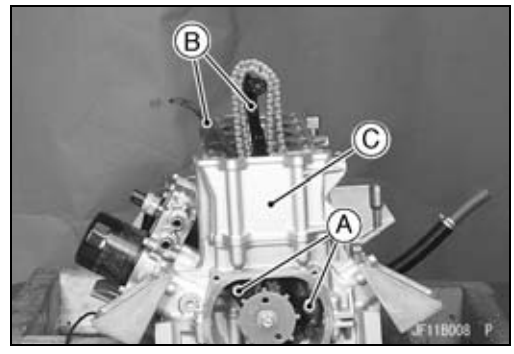
- Drain the engine oil (see Periodic Maintenance chapter).
- Remove:
  Engine (see Engine Removal/Installation chapter)
  Cylinder Head (see Cylinder Head Removal)
  Dipstick Tube Bolts [A]
  Dipstick Tube [B]



- Remove:
  Breather Case Mounting Bolts [A] (JT1500B7F Model)
  Clamp [B]
  Breather Case [C] (JT1500B7F Model)
  Oil Hose [D]



- Remove:
  Camshaft Chain Guide Bolts [A]
  Camshaft Chain Guide [B]
  Cylinder [C]

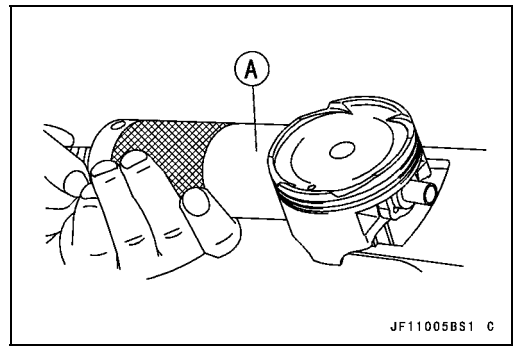


Piston Removal

- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the pistons and remove the piston pin snap ring [A] from the outside of each piston.

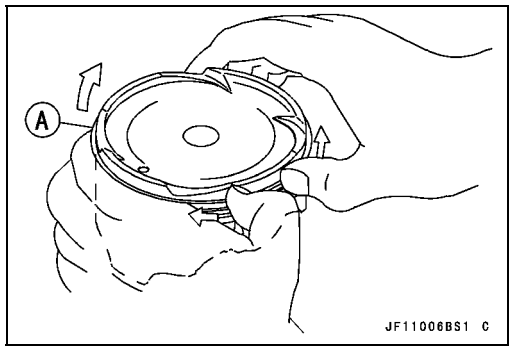
CAUTION
Do not reuse the snap rings, as removal weakens and deforms them. They fall out and score the cylinder wall.

- Remove the piston pins with a piston pin puller [A].
  Special Tool - Piston Pin Puller Assembly: 57001-910
- Remove the pistons.



Cylinder, Pistons

- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



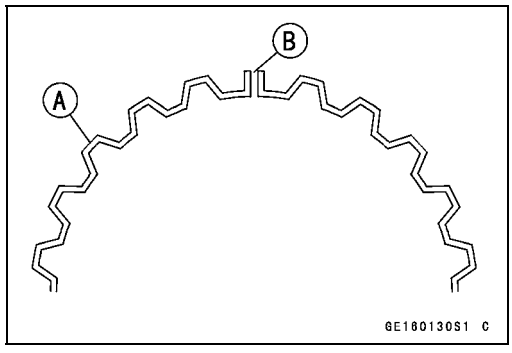
Piston/Cylinder Installation

NOTE

○*If a new cylinder is used, use new piston rings.*
○*If new pistons and/or a new cylinder are installed, apply thin coat of molybdenum disulfide oil solution to the new pistons and cylinder bores.*

- Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
- Install the oil ring steel rails, one above the expander and one below it.

○Spread the rail with your thumbs, but only enough to fit the rail over the piston.
○Release the rail into the bottom piston ring groove.

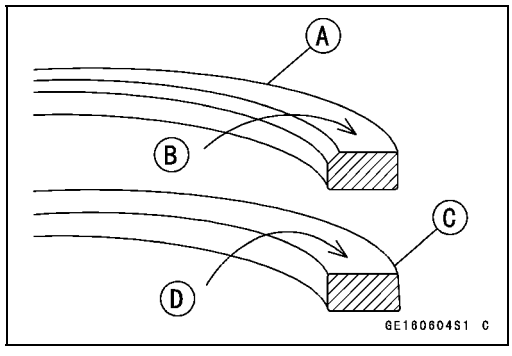


NOTE

○*The oil ring rails have no "top" or "bottom".*

- Do not mix up the top and second ring.
- Install the top ring [A] so that the "R" mark [B] faces up.

○Install the second ring [C] so that the "RN" mark [D] faces up.
○Apply molybdenum disulfide oil solution to the piston rings.

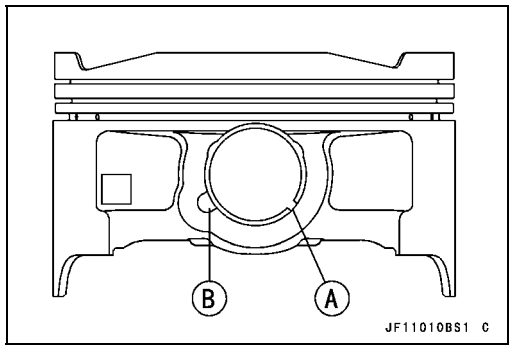


NOTE

○*If a new piston is used, use new piston ring.*

- Install the piston with its marking hollow facing exhaust side.
- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.

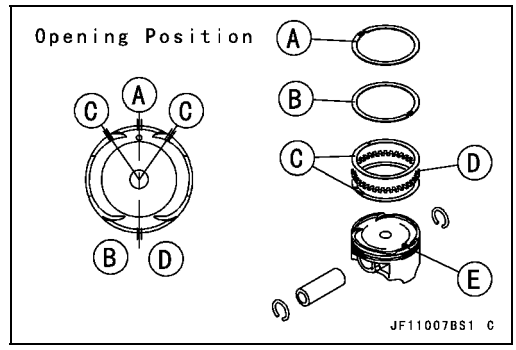
○Apply molybdenum disulfide oil solution to the piston pins and piston journals.
○When installing the piston pin snap ring, compress it only enough to install it and no more.



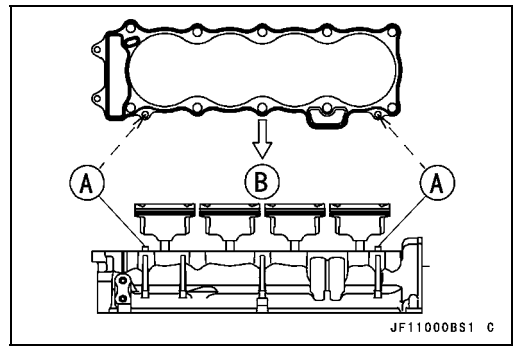
CAUTION
Do not reuse snap rings, as removal weakens and deforms them. **They could fall out and score the cylinder wall.**

Cylinder, Pistons

- The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 ~ 40° of angle from the opening of the top ring.
  [A] Top Ring
  [B] Second Ring
  [C] Oil Ring Steel Rails
  [D] Oil Ring Expander
  [E] Hollow (Exhaust Side)



- Replace the cylinder gasket with a new one, and install the pins [A] and new cylinder gasket.
  Exhaust Side [B]
- Apply molybdenum disulfide oil solution to the cylinder bore, external of pistons and piston rings.

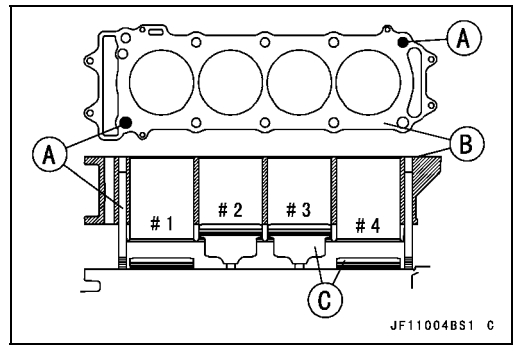


- Insert the piston in the cylinder by two methods.

With the Hand

- Position the crankshaft at #2, #3 piston TDC.
- Install the two cylinder head bolts [A] diagonally in the crankcase.
- Install the cylinder block [B].
  Pistons [C]

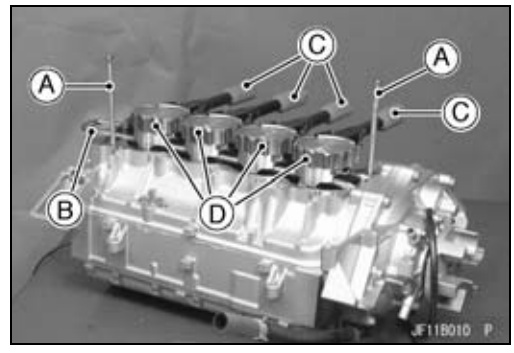
○First insert the #2, #3 pistons, and then rotate the crankshaft at 90° angle.
○Insert the piston rings with your thumbs or the thin (–) screw driver.



With the Special Tools

- Install the two cylinder head bolts [A] diagonally in the crankcase.
- Slip the piston bases [B] under the pistons to hold them level.
- Compress the piston rings using the piston ring compressor grips [C] and piston ring compressor belts [D] with chamfered side upward.

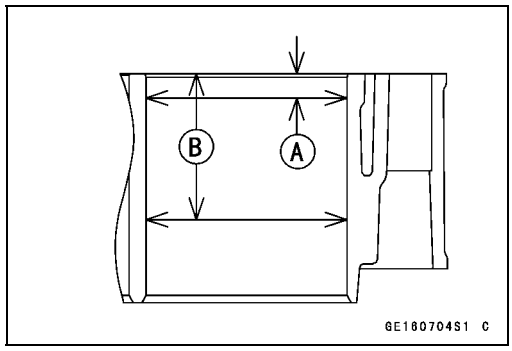
Special Tools - Piston Base, ϕ8: 57001-1604
Piston Ring Compressor Grip: 57001-1095
Piston Ring Compressor Belt, ϕ80 ~ ϕ91: 57001-1320



- Push down vigorously the cylinder aligning the cylinder bores with all the piston heads.
- Install the cylinder so that its angle aligns the piston angle after removing the piston ring compressor belts.
- Install the removed parts.

Cylinder, Pistons

Cylinder Wear

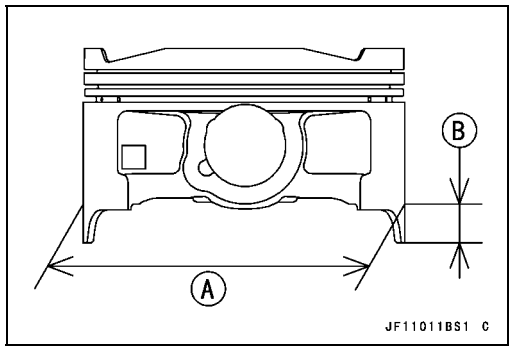


- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the two locations (total of four measurements) shown in the figure.

★If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.
[A] 10 mm (0.39 in.)
[B] 60 mm (2.36 in.)

Cylinder Inside Diameter
Standard: 82.994 ~ 83.006 mm (3.2675 ~ 3.2679 in.)
Service Limit: 83.10 mm (3.272 in.)

Piston Wear

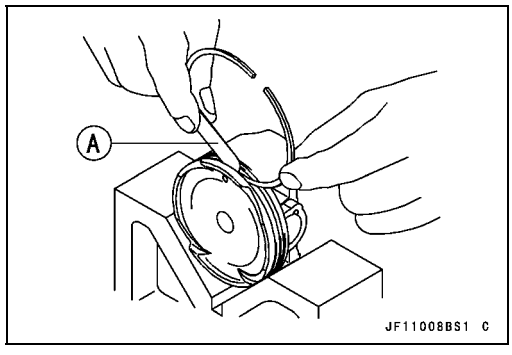


- Measure the outside diameter [A] of each piston 18 mm (0.71 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

★If the measurement is less than the service limit, replace the piston.

Piston Diameter
Standard: 82.919 ~ 82.934 mm (3.2645 ~ 3.2651 in.)
Service Limit: 82.77 mm (3.259 in.)

Piston Ring, Piston Ring Groove Wear



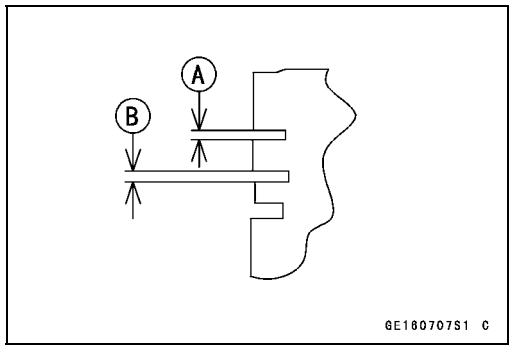
- Check for uneven groove wear by inspecting the ring seating.

★The rings should fit perfectly parallel to groove surfaces. If not, replace the piston and all the piston rings.

- With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.

Piston Ring/Groove Clearance
Standard:
Top 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)
Second 0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)
Service Limit:
Top 0.17 mm (0.0067 in.)
Second 0.16 mm (0.0063 in.)

Piston Ring Groove Width



- Measure the piston ring groove width.

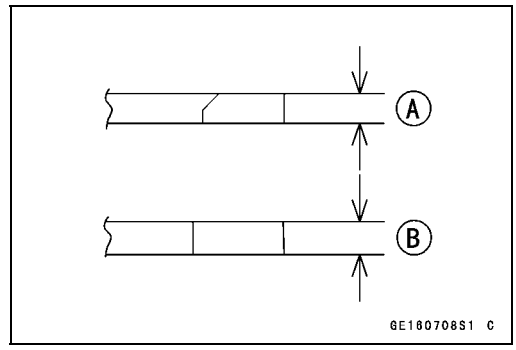
○Use a vernier caliper at several points around the piston.

Standard:
Top [A] 0.92 ~ 0.94 mm (0.0362 ~ 0.0370 in.)
Second [B] 1.01 ~ 1.03 mm (0.0398 ~ 0.0406 in.)
Service Limit:
Top [A] 1.02 mm (0.0402 in.)
Second [B] 1.11 mm (0.0437 in.)

★If the width of any of the two grooves is wider than the service limit at any point, replace the piston.

Cylinder, Pistons

Piston Ring Thickness



● Measure the piston ring thickness.

○Use the micrometer to measure at several points around the ring.

Piston Ring Thickness

Standard:

Top [A]	**0.87 ~ 0.89 mm (0.0343 ~ 0.0350 in.)**
Second [B]	**0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)**

Service Limit:

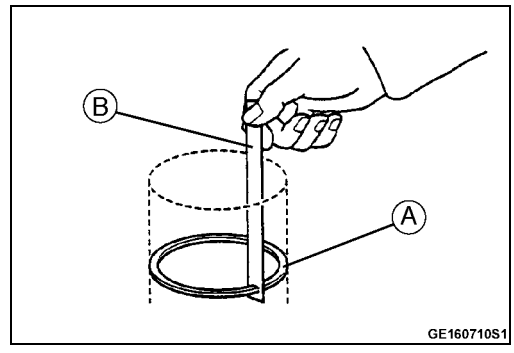
Top [A]	**0.80 mm (0.0315 in.)**
Second [B]	**0.90 mm (0.0354 in.)**

★If any of the measurements is less than the service limit on either of the rings, replace all the rings.

NOTE

○*When using new rings in a used piston, check for uneven groove wear. The rings should fit perfectly parallel to the groove sides. If not, replace the piston.*

Piston Ring End Gap



● Place the piston ring [A] inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.

● Measure the gap between the ends of the ring with a thickness gauge [B].

Piston Ring End Gap

Standard:

Top	**0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in.)**
Second	**0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)**

Service Limit:

Top	**0.7 mm (0.0276 in.)**
Second	**0.8 mm (0.0315 in.)**

★If the end gap of either ring is greater than the service limit, replace all the rings.

Engine Removal/Installation

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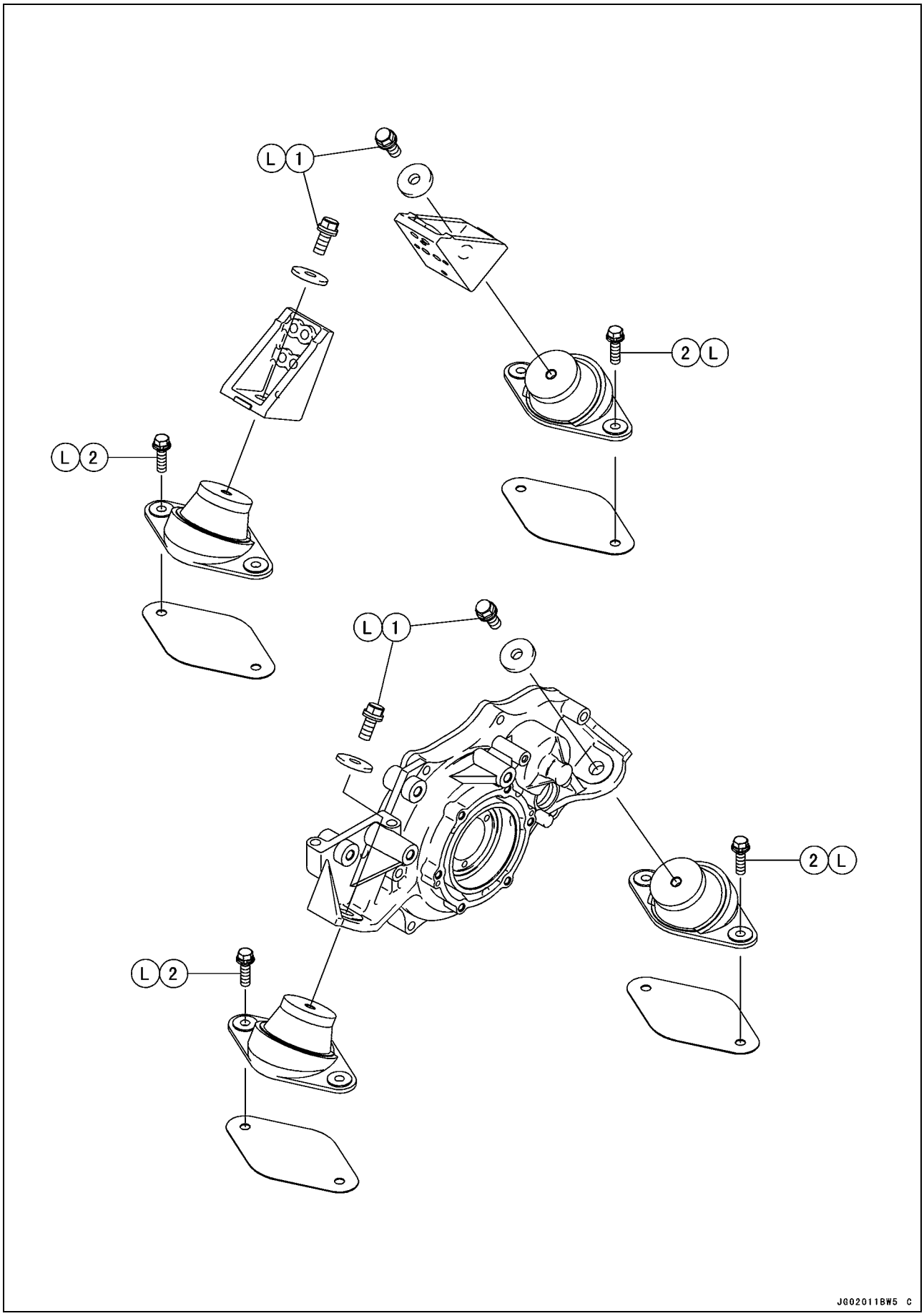
Exploded View



Exploded View

No	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Mounting Bolts	36	3.7	27	L
2	Engine Damper Mounting Bolts	16	1.6	12	L

L: Apply a non-permanent locking agent.

Engine Removal/Installation

Engine Removal

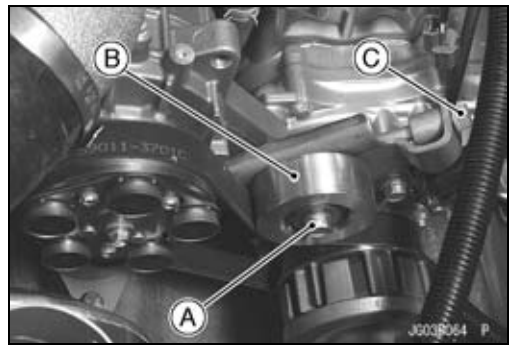
● Remove:
Seat (see Seat Removal in the Hull/Engine Hood chapter)
Rear Grip Plate (see Rear Grip Plate Removal in the Hull/Engine Hood chapter)
Oil Separator Tank (see Oil Separator Tank Removal in the Engine Lubrication System chapter)

NOTE

○*When the oil separator tank is removed, plug the oil hose (Oil Separator Tank ~ Oil Pan) end [A]. If the oil hose lies down, the oil will flow out from hose end.*

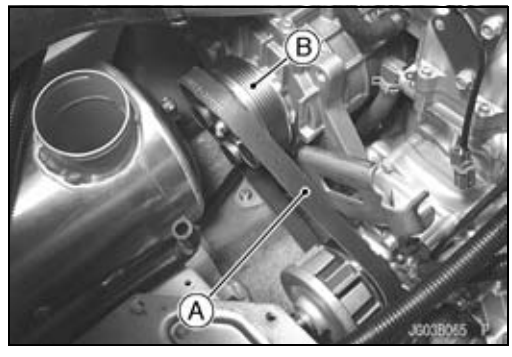
★If the engine is disassembled, drain the oil (see Engine Oil Change in the Periodic Maintenance chapter).

● Remove:
Intercooler (see Intercooler Removal in the Cooling and Bilge Systems)
Inlet Manifold (see Inlet Manifold Removal in the Fuel System (DFI) chapter)
Exhaust Pipe and Muffler Body (see Exhaust Pipe and Muffler Body Removal in the Exhaust System chapter)
Steering Cover (see Steering Removal in the Steering Removal)



● Remove the belt cover (see Supercharger Drive Belt for Wear/Damage and Belt Tension Inspection in the Periodic Maintenance chapter).

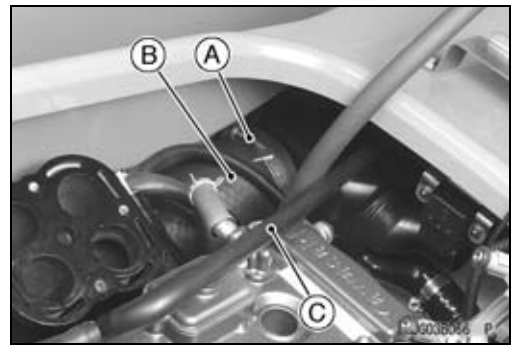
● Remove:
Idler Bolt [A] and Idler [B]
Adjuster [C]



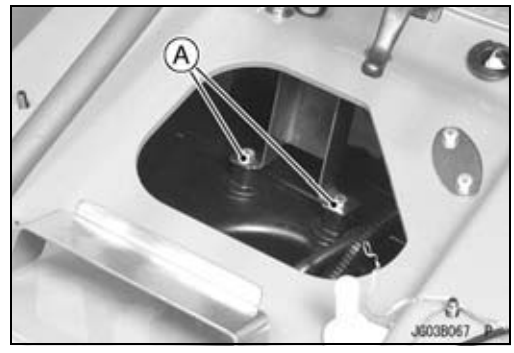
● Remove the supercharger drive belt [A] from the supercharger pulley [B].

Engine Removal/Installation

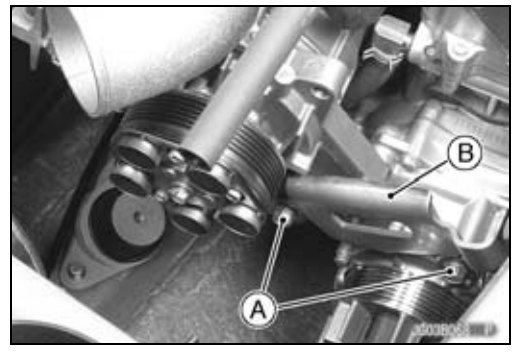
- Loosen the clamp [A] and disconnect the tube [B] from the air box fitting.
- Disconnect the air suction valve hose [C] from the air box (JT1500B7F model).



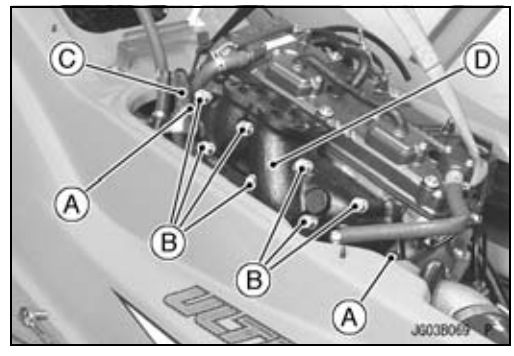
- Remove the bracket bolts [A] holding the air box.



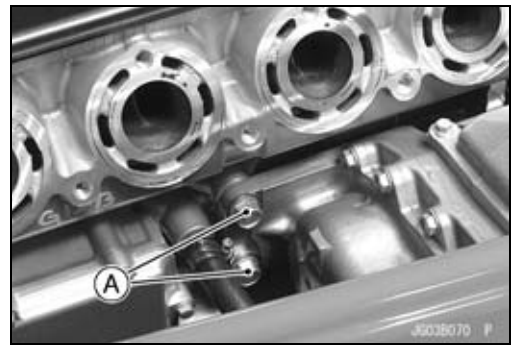
- Slide the engine toward the front to disengage the coupling.
- Remove the supercharger drive belt from the coupling.
- Remove:
  Belt Tensioner Plate Bolts [A]
  Belt Tensioner Plate [B]



- Using the lifter, lift the engine as shown.
- Unscrew the exhaust manifold nuts [A] and bolts [B].
- Disconnect the flushing hose [C].
- Remove the exhaust manifold [D].



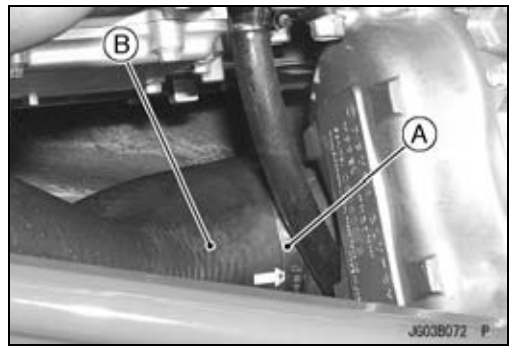
- Remove the front supercharger bolts [A].



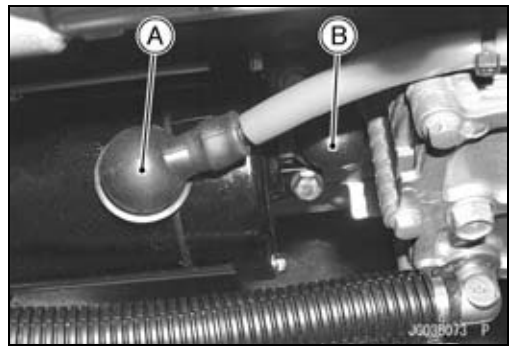
Engine Removal/Installation

● Remove the rear supercharger bolts [A].

● Loosen the clamp [A] and remove the tube [B] from the supercharger.
● Remove the supercharger from the engine compartment.

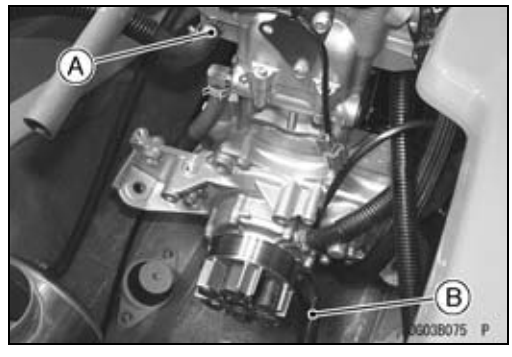


● Disconnect:
Starter Motor Cable [A]
Battery (–) Cable [B]



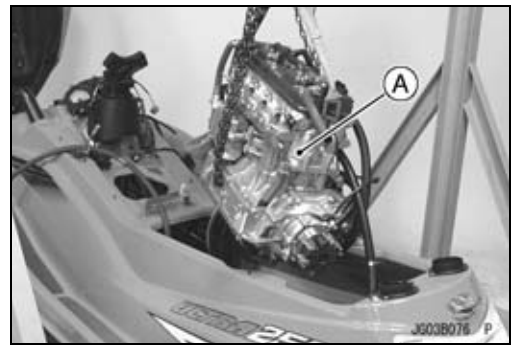
● Disconnect the cooling hose [A] on the cylinder.

● Disconnect:
Cooling Hose [A] on Cylinder Head
Cooling Hose [B] on Output Cover



Engine Removal/Installation

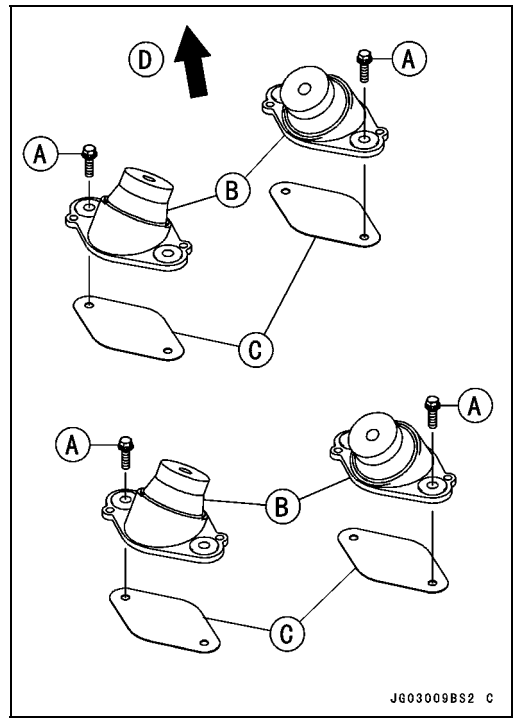
- Lift the engine [A] from the engine compartment.



Engine Damper Removal

- Remove:
  Engine Damper Mounting Bolts [A]
  Engine Damper [B]
  Shim [C] (0 ~ 2 pieces)
  Bow [D]
- Record the number of shims of four positions so they can be put back in the same position.

CAUTION
Install the shims to the same position. Incorrect shims could cause drive shaft misalignment.



Engine Damper Installation

- Install the shim(s) of the same number.
- Apply a non-permanent locking agent to the engine damper mount bolts, and tighten them.

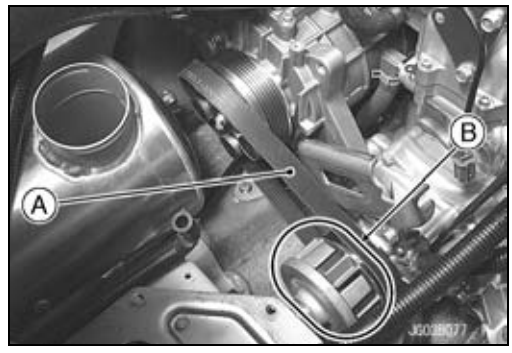
Torque - Engine Damper Mounting Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)

Engine Installation

- Be sure there are no foreign objects and parts inside of the hull.
- Clean the bilge filter (see Filter Cleaning and Inspection in Cooling and Bilge Systems chapter).
- Check the coupling damper for wear damage (see Coupling Damper Inspection in Engine Bottom End chapter).

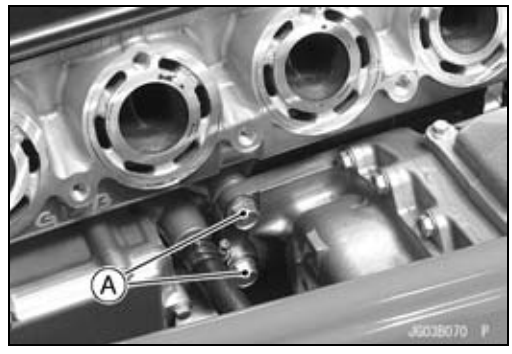
Engine Removal/Installation

- Do not forget installing the supercharger drive belt [A] when engaging the couplings [B].



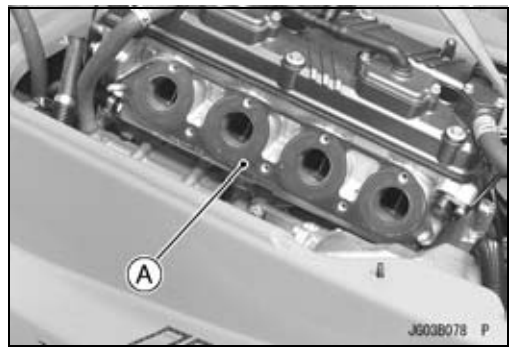
- Torque:

  Torque - Front/Rear [A] Supercharger Bolts: 45 N·m (4.6 kgf·m, 33 ft·lb)



- Install the new gasket [A] before installing the exhaust manifold.
- Torque:

  Torque - Exhaust Manifold Mounting Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)
  Exhaust Manifold Mounting Bolts: 30 N·m (3.1 kgf·m, 22 ft·lb)



- Apply a non-permanent locking agent to the engine mounting bolts, and tighten them.

  Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

Engine Removal/Installation

- After installing the engine in the hull, check the following.
  Throttle Cable
  Fuel and Exhaust Leaks

⚠ WARNING

Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas which can be lethal.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds, especially in high revolutionary speed or severe engine and exhaust system damage will occur.

Engine Bottom End

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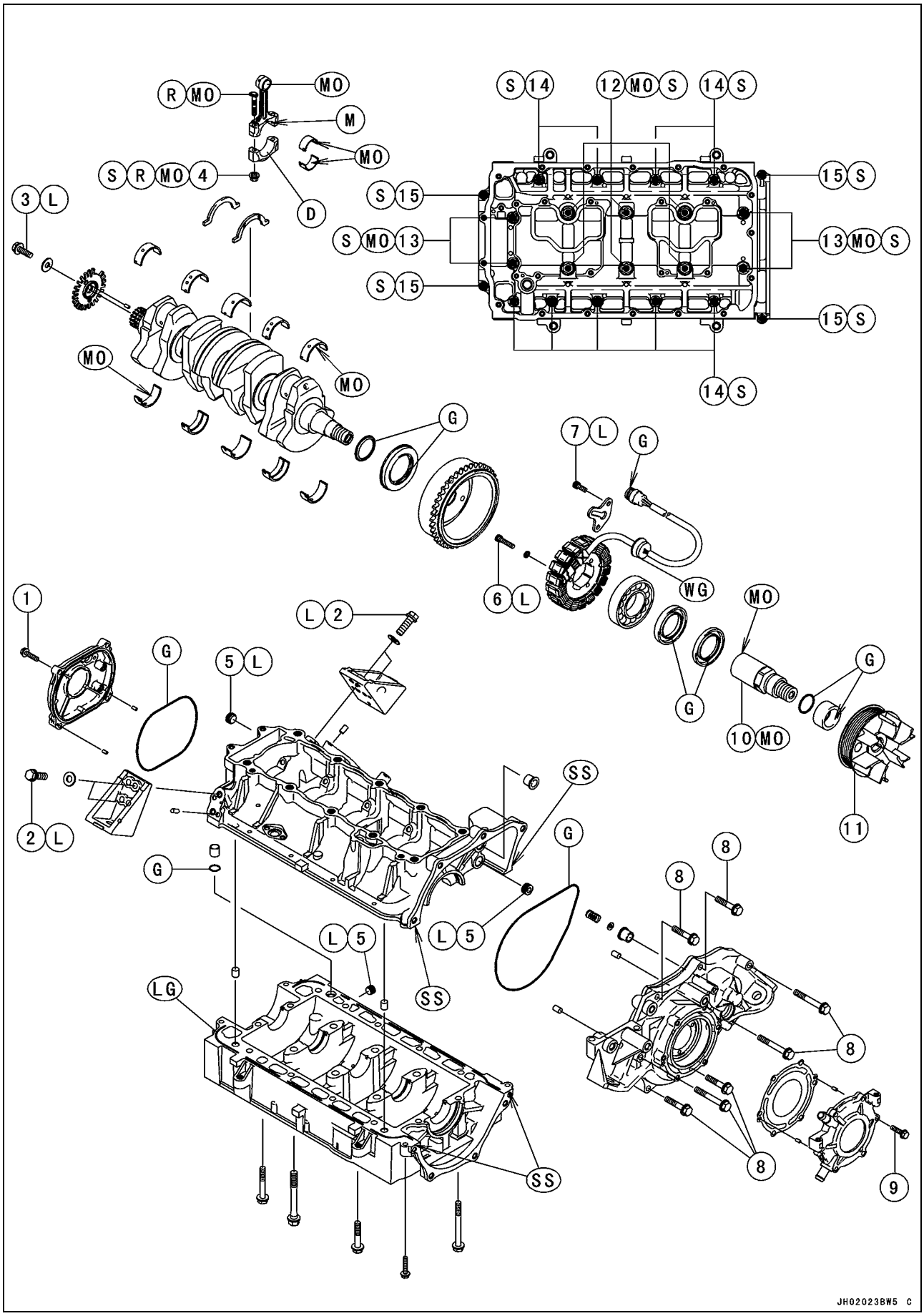
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
2	Engine Bracket Mounting Bolts	32	3.3	24	L
3	Timing Rotor Bolt	20	2.0	14	L
4	Connecting Rod Nuts	–	–	–	MO, see text
5	Oil Passage Plugs	20	2.0	14	L
6	Stator Mounting Bolts	12	1.2	104 in·lb	L
7	Grommet Cover Bolts	9.8	1.0	87 in·lb	L
8	Magneto Cover Bolts	20	2.0	14	
9	Output Cover Bolts	7.8	0.80	69 in·lb	
10	Output Shaft	245	25.0	180	MO
11	Coupling	110	11	81	
12	Crankcase Bolts (M10)	50	5.0	36	MO, S
13	Crankcase Bolts (M8)	29	3.0	22	MO, S
14	Crankcase Bolts (M8)	29	3.0	22	S
15	Crankcase Bolts (M6)	12	1.2	104 in·lb	S

D: Do not apply any grease or oil.
G: Apply grease.
L: Apply a non-permanent locking agent.
LG: Apply liquid gasket (Kawasaki Bond: 92104-1062).
M: Apply molybdenum disulfide grease.
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).
R: Replacement Parts.
S: Follow the specific tightening sequence.
SS: Apply silicone sealant.
WG: Apply water resistant grease.

Specifications

Item	Standard	Service Limit
Crankshaft, Connecting Rods		
Connecting Rod Bend	– – –	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	– – –	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Side Clearance	0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)	0.58 mm (0.023 in.)
Connecting Rod Big end Bearing Insert/crankpin Clearance	0.041 ~ 0.071 mm (0.0016 ~ 0.0028 in.)	0.11 mm (0.0043 in.)
Crankpin Diameter:	38.984 ~ 39.000 mm (1.5348 ~ 1.5354 in.)	38.97 mm (1.534 in.)
Marking:		
None	38.984 ~ 38.992 mm (1.5348 ~ 1.5351 in.)	– – –
○	38.993 ~ 39.000 mm (1.5352 ~ 1.5354 in.)	– – –
Connecting Rod Big End Bore Diameter:	42.000 ~ 42.016 mm (1.6535 ~ 1.6542 in.)	– – –
Marking		
None	42.000 ~ 42.008 mm (1.6535 ~ 1.65386 in.)	– – –
○	42.009 ~ 42.016 mm (1.65389 ~ 1.6542 in.)	– – –
Connecting Rod Big End Bearing Insert Thickness:		
Brown	1.475 ~ 1.480 mm (0.05807 ~ 0.05827 in.)	– – –
Black	1.480 ~ 1.485 mm (0.05827 ~ 0.05846 in.)	– – –
Blue	1.485 ~ 1.490 mm (0.05846 ~ 0.05866 in.)	– – –

Connecting Rod Big End Bearing Insert Selection

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-3710
None	None	Black	92139-3709
○	○		
○	None	Blue	92139-3708

Crankshaft Side Clearance	0.05 ~ 0.24 mm (0.0020 ~ 0.0094 in.)	0.44 mm (0.017 in.)
Crankshaft Runout	TIR 0.03 mm (0.0012 in.) or less	TIR 0.07 mm (0.0028 in.)
Crankshaft Main Bearing Insert/journal Clearance	0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)	0.08 mm (0.0032 in.)

Specifications

Item	Standard	Service Limit
Crankshaft Main Journal Diameter:	40.984 ~ 41.000 mm (1.6135 ~ 1.6142 in.)	40.96 mm (1.613 in.)
Marking		
None	40.984 ~ 40.992 mm (1.6135 ~1.61385 in.)	– – –
1	40.993 ~ 41.000 mm (1.61389 ~ 1.6142 in.)	– – –
Crankcase Main Bearing Bore Diameter:	44.000 ~ 44.016 mm (1.7323 ~ 1.7329 in.)	– – –
Marking		
○	44.000 ~ 44.008 mm (1.7323 ~ 1.73259 in.)	– – –
None	44.009 ~ 44.016 mm (1.73263 ~ 1.7329 in.)	– – –
Crankshaft Main Bearing Insert Thickness:		
Brown	1.490 ~ 1.494 mm (0.05866 ~ 0.05882 in.)	– – –
Black	1.494 ~ 1.498 mm (0.05882 ~ 0.05898 in.)	– – –
Blue	1.498 ~ 1.502 mm (0.05898 ~ 0.05913 in.)	– – –

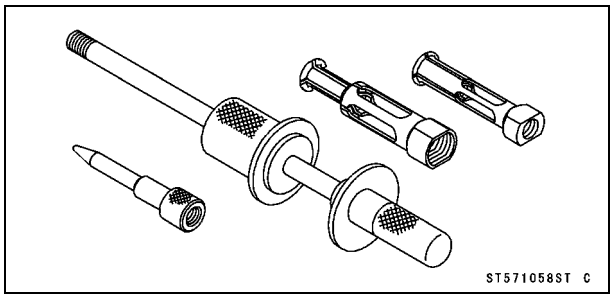
Crankshaft Main Bearing Insert Selection

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal Nos.
○	1	Brown	92139-3704	1, 5
			92139-3713	3
			92139-3707	2, 4
○	None	Black	92139-3703	1, 5
None	1		92139-3712	3
			92139-3706	2, 4
None	None	Blue	92139-3702	1, 5
			92139-3711	3
			92139-3705	2, 4

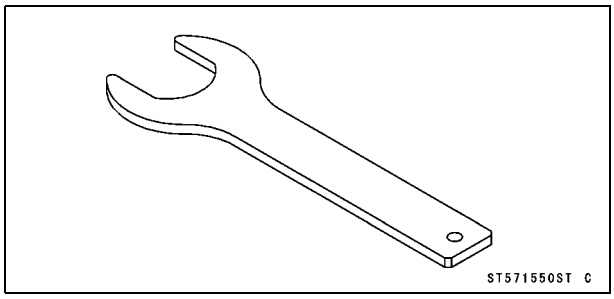
*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

Special Tools and Sealant

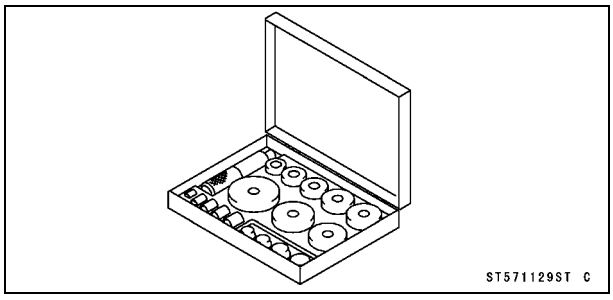
Oil Seal & Bearing Remover:
57001-1058



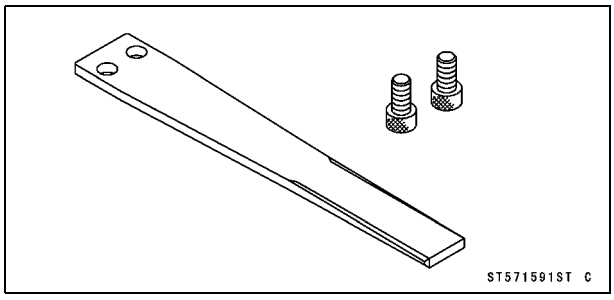
Output Shaft Wrench, Hex 36:
57001-1550



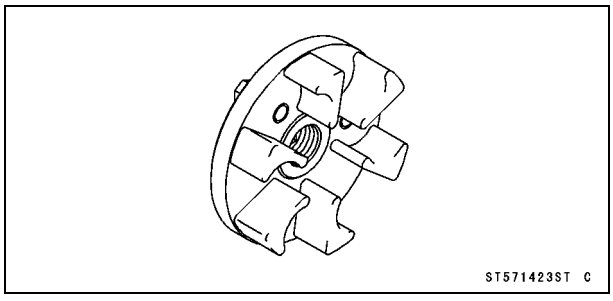
Bearing Driver Set:
57001-1129



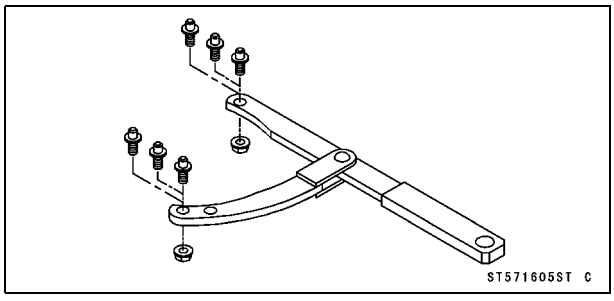
Grip:
57001-1591



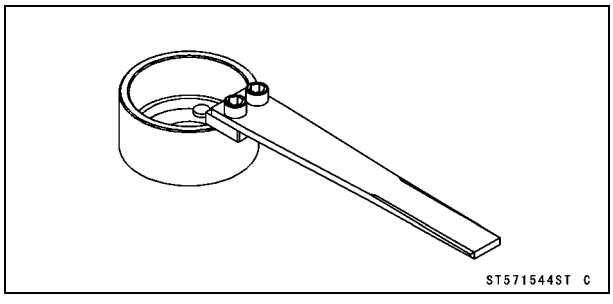
Coupling Holder #2:
57001-1423



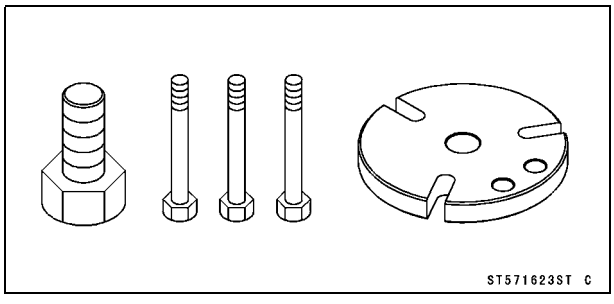
Flywheel & Pulley Holder:
57001-1605



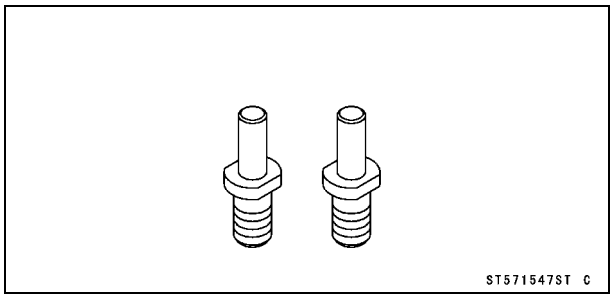
Rotor Holder:
57001-1544



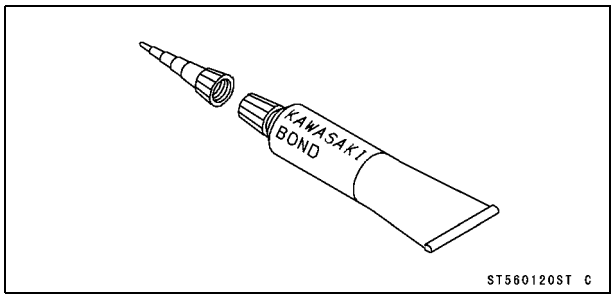
Rotor Puller:
57001-1623



Holder Attachment:
57001-1547

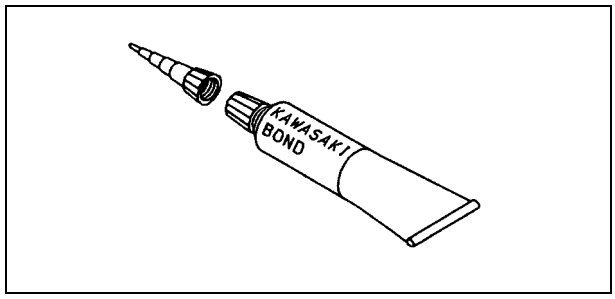


Kawasaki Bond (Silicone Sealant):
56019-120



Special Tools and Sealant

Kawasaki Bond (Liquid Gasket - Black):
92104-1062

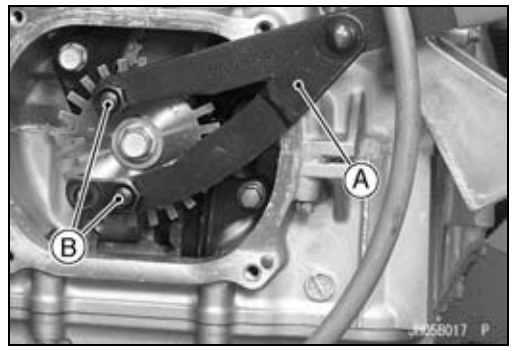


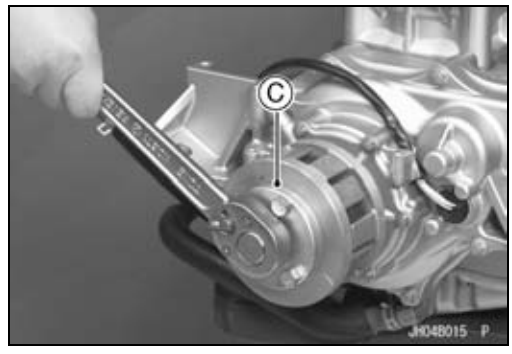
Coupling

Coupling/Output Shaft Removal

- Remove:
  Engine (see Engine Removal/Installation chapter)
  Crankshaft Sensor Cover (see Electrical System chapter)
- Holding the timing rotor, unscrew the coupling.

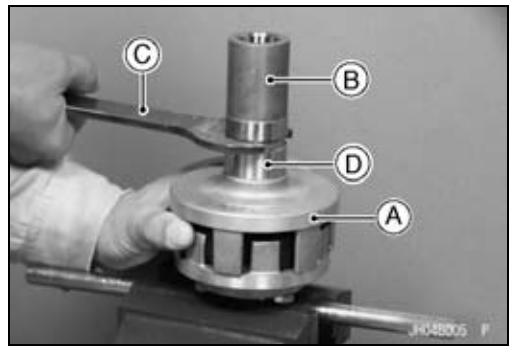
Special Tools - Flywheel & Pulley Holder: 57001-1605 [A]
Holder Attachment: 57001-1547 [B]
Coupling Holder #2: 57001-1423 [C]



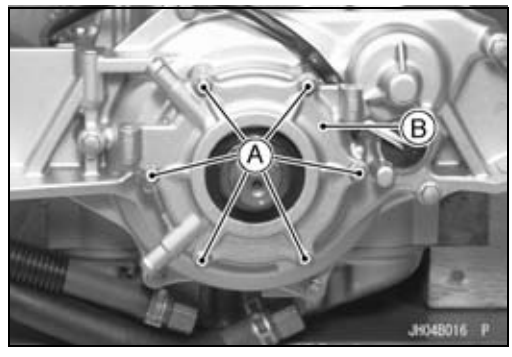


★If the coupling [A] and output shaft [B] removed together, holding the coupling, unscrew the output shaft with the output shaft wrench [C].
Collar [D]

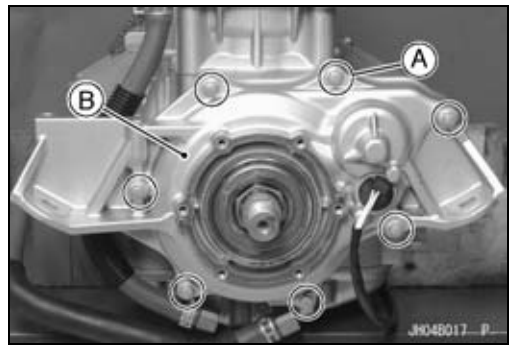
Special Tool - Output Shaft Wrench, Hex 36: 57001-1550



- Remove:
  Output Cover Bolts [A]
  Output Cover [B]



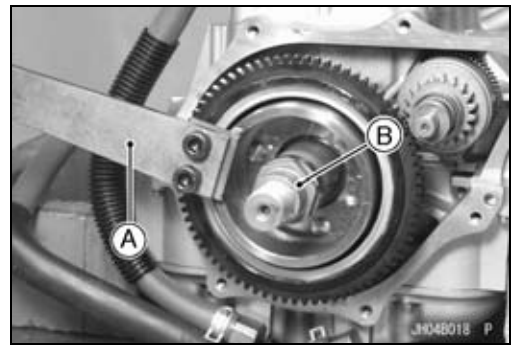
- Remove:
  Magneto Cover Bolts [C]
  Magneto Cover



Coupling

- Using the rotor holder [A], remove the output shaft [B].

  Special Tool - Rotor Holder: 57001-1544

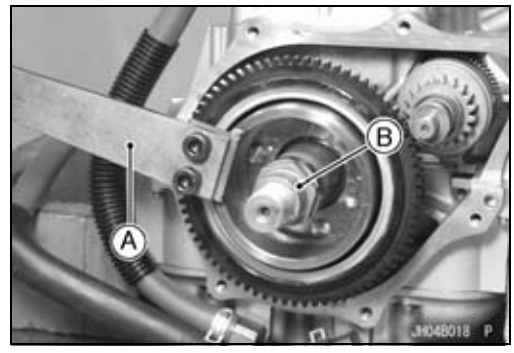


Coupling/Output Shaft Installation

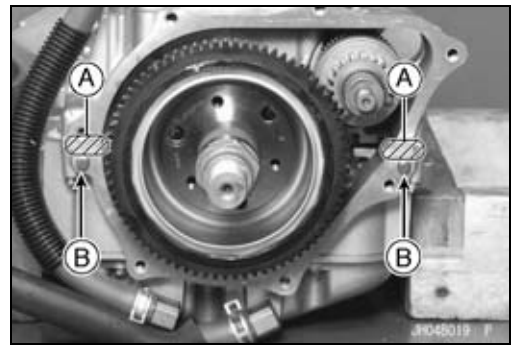
- Apply molybdenum disulfide oil solution to the seating surface of the output shaft.
- Using the rotor holder [A], install the output shaft [B].

  Special Tool - Rotor Holder: 57001-1544

  Torque - Output Shaft: 245 N·m (25.0 kgf·m, 180 ft·lb)



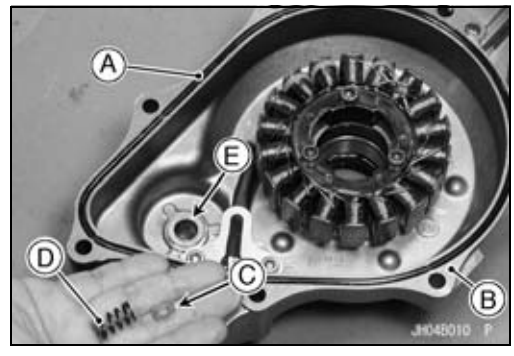
- Apply silicone sealant [A] to the crankcase halves mating surfaces on the magneto cover.
- Be sure to install the dowel pins [B].



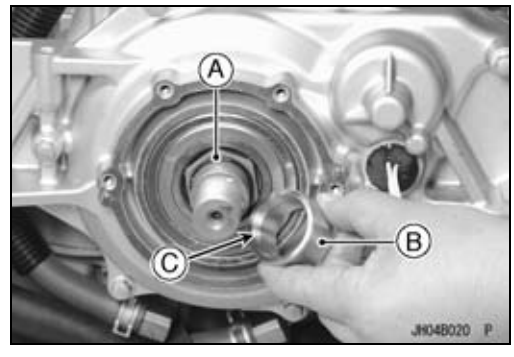
- Apply grease to the O-ring [A], and fit the O-ring onto the groove of the magneto cover [B].
- Install the magneto cover.

○Be sure to install the washer [C] and the spring [D] into the hole [E] of the bushing.

Torque - Magneto Cover Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)

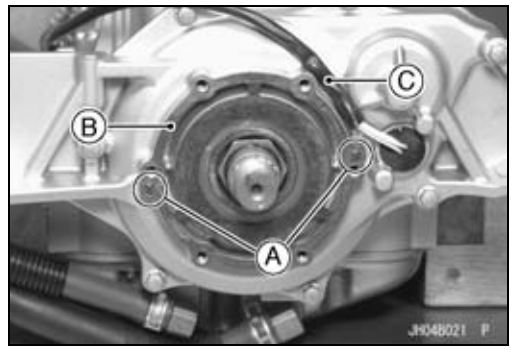


- Apply grease to the O-ring [A] and collar inside.
- Install the collar [B] so that the chamfer side [C] faces inward.



Coupling

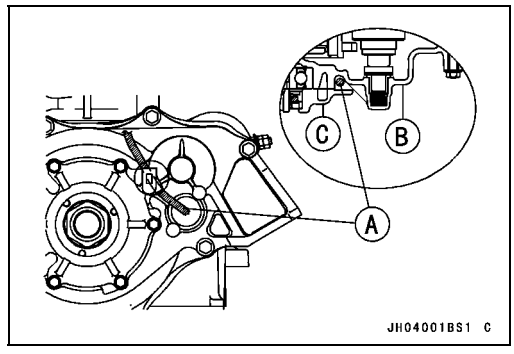
- Install:
  Pins [A]
  Gasket [B]
- Position the magnet lead [C] as shown.



- Apply grease to the oil seal lip.
- Install the output cover.

○Run the magneto lead [A] between the magneto cover [B] and the output cover [C] as shown.

Torque - Output Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

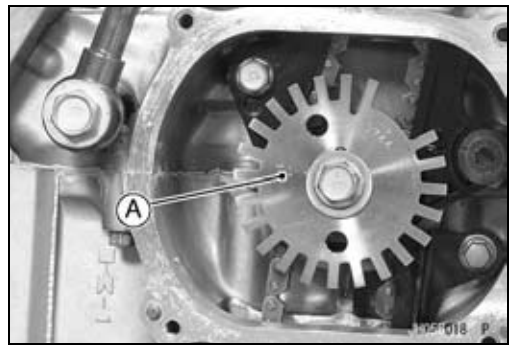


- Install the coupling by using the old timing rotor as a holding tool.

Special Tools - Flywheel & Pulley Holder: 57001-1605
Holder Attachment: 57001-1547
Coupling Holder #2: 57001-1423

Torque - Coupling: 110 N·m (11 kgf·m, 81 ft·lb)

- Then remove the timing rotor. **This removed rotor should be stored as a special tool** by grinding the projection or marking an adequate mark for verifying.
- Then install one **new** timing rotor [A]. Use the following as a new part.



Model Name	Part No.
JT1500C7F	21007-3744

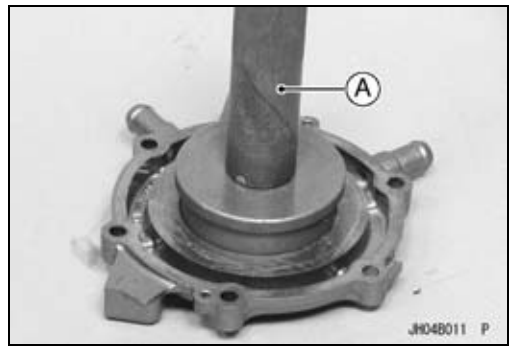
Coupling Damper Inspection

- Refer to Coupling Damper Inspection in the Periodic Maintenance chapter.

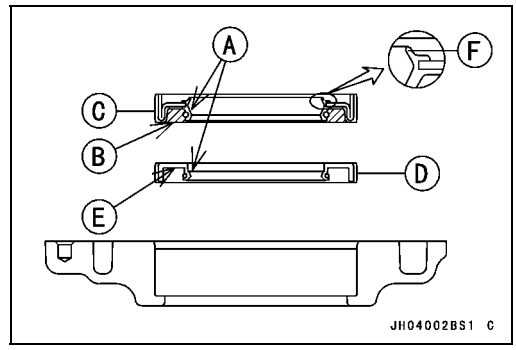
Output Cover Oil Seal Replacement

- Remove:
  Output Cover (see Coupling/Output Shaft Removal)
- Using the bearing driver [A], remove the oil seals as a set.

Special Tool - Bearing Driver Set: 57001-1129



Coupling



- Replace the oil seals with new ones.
- Apply thin coat grease to the oil seal lips [A].
- Pack grease [B] between the oil seal lip and housing of the oil seal (flywheel side oil seal [C]).
- Press in the oil seals until they are bottomed.

○Install the coupling oil seal [D] so that the manufacturer's marks [E] face coupling side.

○Install the flywheel side oil seal so that the dust seal [F] side face out.

Oil Seal Inspection

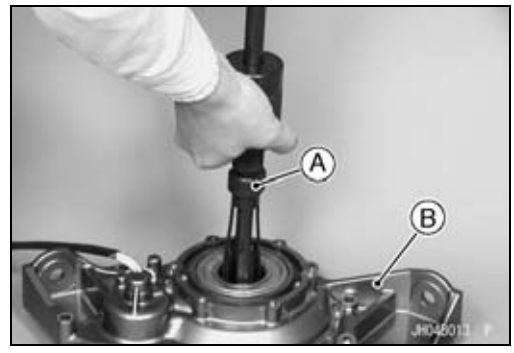
- Inspect the oil seal.

○Replace it if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened or otherwise damaged.

Magneto Cover Bearing Replacement

CAUTION

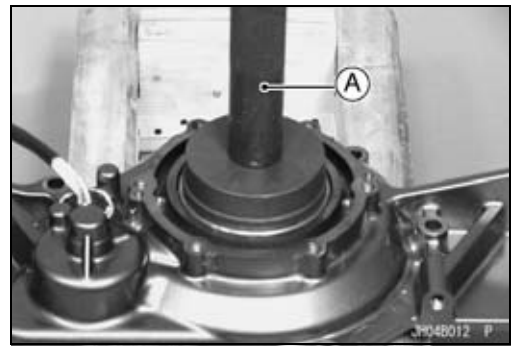
Do not remove the ball bearing unless it is necessary. Removal may damage it.



- Remove:
  Magneto Cover (see Coupling/Output Shaft Removal)
- Using the oil seal and bearing remover [A], remove the ball bearing from the magneto cover [B].

○When removing the ball bearing, hold the magneto cover.

Special Tool - Oil Seal and Bearing Remover: 57001-1058



- Using a press and the bearing driver set [A], install the new bearing until it stops at the bottom of its housing.

Special Tool - Bearing Driver Set: 57001-1129

Ball Bearing Lubrication

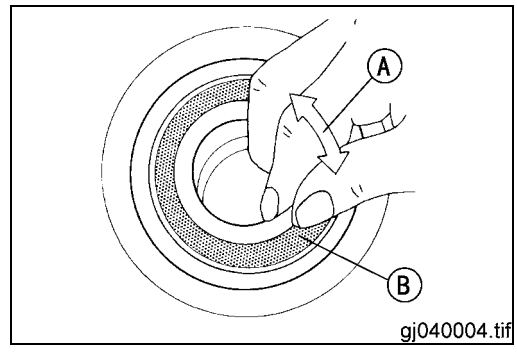
NOTE

○*Since the bearings are packed with grease and sealed on both sides, lubrication is not required.*

Ball Bearing Inspection

NOTE

○*It is not necessary to remove the bearings for inspection. If the bearing is removed, it will need to be replaced with a new one.*



- Spin [A] it by hand to check its condition.

★If it is noisy, does not spin smoothly, or has any rough spots, it must be replaced.

- Examine the bearing seal [B] for tears or leakage.

★If the seal is torn or is leaking, replace the bearing.

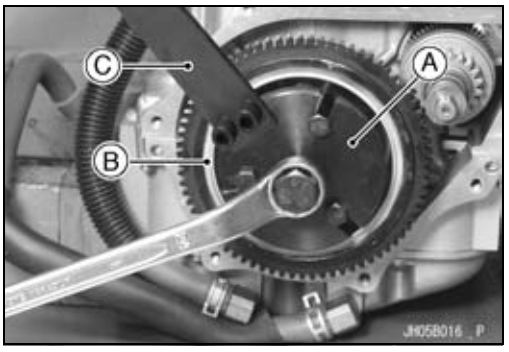
Magneto Flywheel

Magneto Flywheel Removal

● Remove:
Engine (see Engine Removal/Installation chapter)
Crankshaft Sensor Cover (see Electrical System chapter)
Coupling (see Coupling/Output Shaft Removal)
Magneto Cover (see Coupling/Output Shaft Removal)

○Using the rotor puller [A], pull off the flywheel [B].

Special Tool - Rotor Puller: 57001-1623
Grip: 57001-1591 [C]

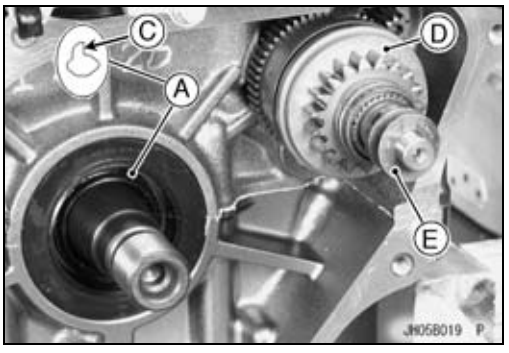


CAUTION

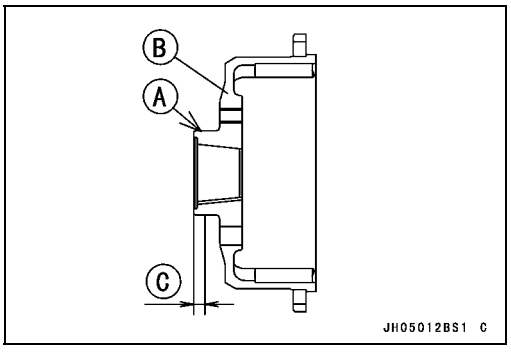
Do not hit the head of the rotor puller. A loss in rotor magnetism may be caused.

Magneto Flywheel Installation

● Using a high-flash points solvents, clean off any oil or dirt that may be on the crankshaft taper, and in the tapered hole in the magneto flywheel.
● Install the O-ring [A] directly as shown.
○This face [C] is magneto flywheel side.
★If the reduction gear [D] is removed, apply a molybdenum disulfide grease to both ends of its shaft.
● Install the reduction gear and the washer [E].



● Apply grease to the boss outside [A] of the magneto flywheel [B].
10 mm (0.39 in.) [C]
● Install the magneto flywheel.



NOTE

○*Confirm the magneto flywheel fit or not to the crankshaft before tightening it with specified torque.*

○Install the output shaft and tighten it with 70 N·m (7.0 kgf·m, 52 ft·lb) of torque.
○Remove the output shaft.
○Check the tightening torque with rotor puller.

Special Tool - Rotor Puller: 57001-1623
Grip: 57001-1591

★If the magneto flywheel is not pulled out with 20 N·m (2.0 kgf·m, 52 ft·lb) of drawing torque, it is installed correctly.
★If the magneto flywheel is pulled out with under 20 N·m (2.0 kgf·m, 52 ft·lb) of drawing torque, clean off any oil dirt or flaw of the crankshaft and magneto flywheel tapered portion, and dry them with a clean cloth. Then, confirm that it is not pulled out with above torque.
● Tighten the output shaft while holding the magneto flywheel steady with the rotor holder.

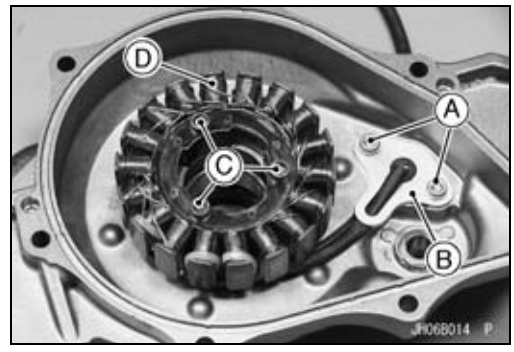
Special Tool - Rotor Holder: 57001-1544

Torque - Output Shaft: 245 N·m (25 kgf·m, 180 ft·lb)

● Install:
Magneto Cover (see Coupling/Output Shaft Installation)

Stator

Stator Removal



- Remove:
  Engine (see Engine Removal/Installation chapter)
  Magneto Cover (see Coupling/Output Shaft Removal)
  Grommet Cover Mounting Bolts [A]
  Grommet Cover [B]
  Stator Mounting Bolts [C] with Washers
  Stator Assembly [D]

Stator Installation

- Apply water resistant grease to the outside of the grommet.
- Apply a non-permanent locking agent to the grommet cover bolts.
- Tighten:

  Torque - Grommet Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

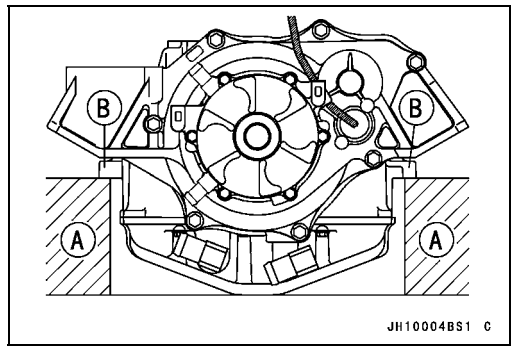
- Apply a non-permanent locking agent to the stator mounting bolts and put the washers.
- Tighten:

  Torque - Stator Mounting Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

○When installing the stator, fix the stator lead to the groove of the magneto cover.
○Be sure to the stator lead have no slack and bite.

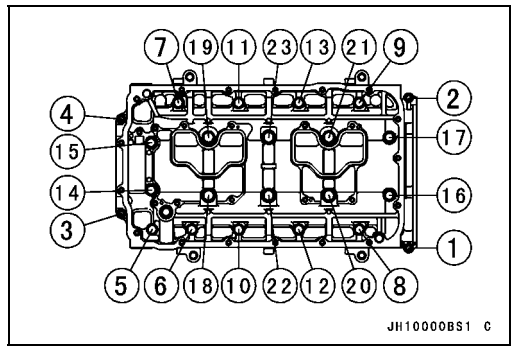
Crankcase Splitting

Crankcase Splitting



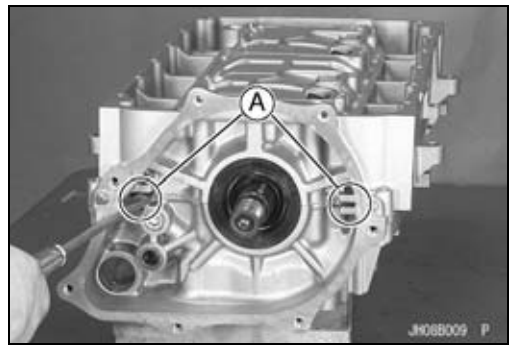
- Remove:
  Seat (see Hull/Engine Hood chapter)
  Engine (see Engine Removal/Installation chapter).
- Drain the engine oil (see Periodic Maintenance chapter).
- Set the engine on a clean surface and hold the engine steady while parts are being removed.
  Suitable Props [A]
  Lower Crankcase Projections [B]

- Remove:
  Crankshaft Sensor Cover (see Electrical System chapter)
  Cylinder Head (see Engine Top End chapter)
  Piston (see Engine Top End chapter)
  Starter Motor (see Electrical System chapter)
  Oil Pump Bodies (see Engine Lubrication System chapter)
  Magneto Flywheel (see Magneto Flywheel Removal)
  Oil Filter (see Periodic Maintenance chapter)

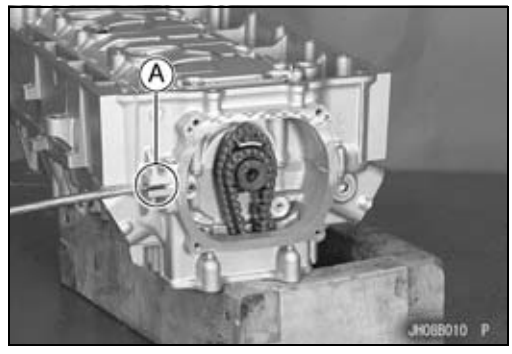


- Remove the crankcase bolts.

○First loosen the M6 bolts [1 ~ 4].
○Next loosen the M8 bolts [5 ~ 17].
○Last loosen the M10 bolts [18 ~ 23].



- Using the pry points [A], split the crankcase halves.
- Lift off the lower crankcase half.



Crankcase Splitting

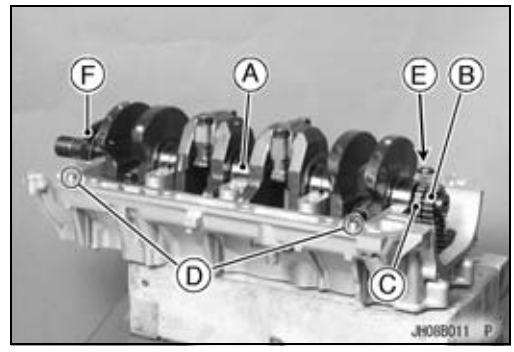
Crankcase Assembly

CAUTION

The upper and lower crankcase halves are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.

- With high-flash point solvent, clean off the mating surfaces of the crankcases halves and wipe dry.
- Using compressed air, blow out the oil passages in the crankcase halves.

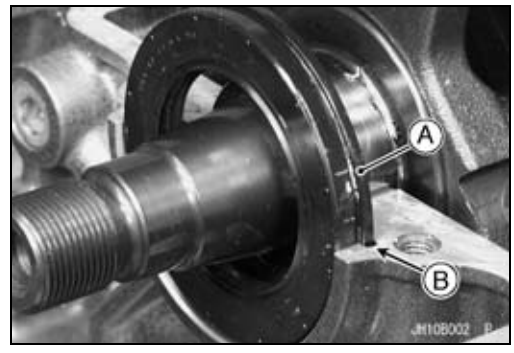
- Install:
  Crankshaft [A] and Connecting Rods (see Crankshaft Installation)
  Camshaft Chain [B]
  Oil Pump Sprocket Chain [C]
  Dowel Pins [D]
  Oil Passage Pipe [E] with O-ring
  Oil Seal [F]



- Before fitting the lower case on the upper case, check the following.

○Be sure to hang the camshaft and oil pump sprocket chain on the crankshaft.

○Check to see that the oil seal [A] is in the groove [B] of the crankcase.



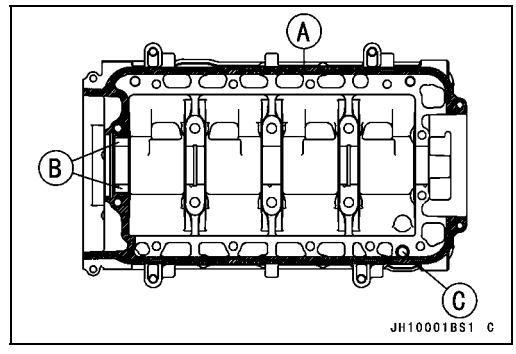
- Apply liquid gasket [A] to the mating surface of the lower crankcase half.

NOTE

○*Make the application finish within 30 minutes when the liquid gasket to the mating surface of the lower crankcase half is applied.*

○*Moreover fit the case and tighten the case bolts just after finishing the application of the liquid gasket.*

Sealant - Kawasaki Bond: 92104-1062

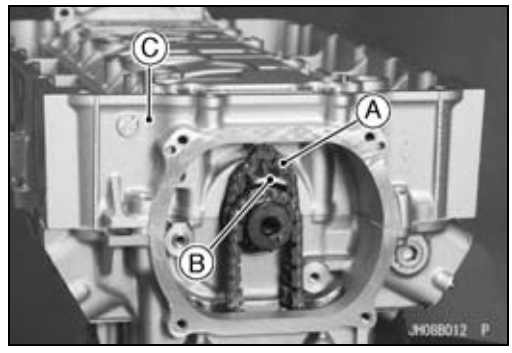


CAUTION

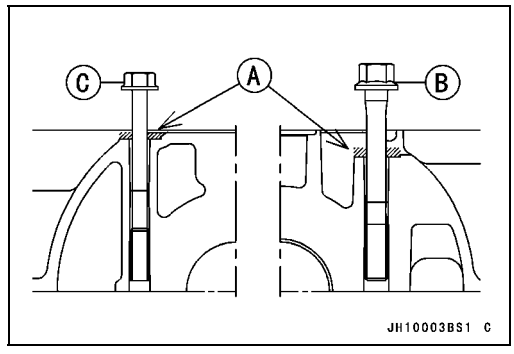
Do not apply liquid gasket around the crankshaft main bearing inserts [B], and oil passage hole [C].

Crankcase Splitting

● Install the oil pump sprocket chain [A] on the chain guide [B] of the lower crankcase [C].



● Apply molybdenum disulfide oil solution to the bolt seating surfaces [A] on the lower crankcase for the M10 bolts [B] and M8 [7 ~ 10] bolts [C].



● Tighten the crankcase bolts.

○Following the sequence numbers on the lower crankcase half, tighten the M10 bolts [1 ~ 6].

Torque - Crankcase Bolts (M10): 50 N·m (5.0 kgf·m, 36 ft·lb)

○Following the sequence numbers, tighten the M8 bolts [7 ~ 10].

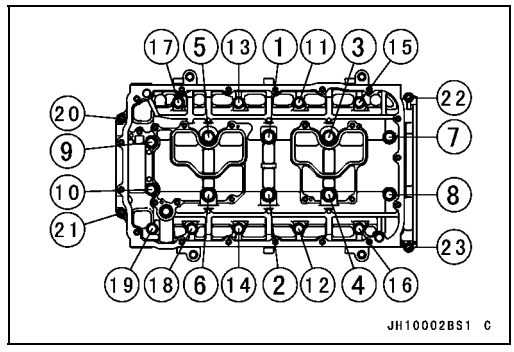
Torque - Crankcase Bolts (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)

○Following the sequence numbers, tighten the M8 bolts [11 ~ 19].

Torque - Crankcase Bolts (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)

○Following the sequence numbers, tighten the M7 bolts [20 ~ 23].

Torque - Crankcase Bolts (M6): 12 N·m (1.2 kgf·m, 104 in·lb)

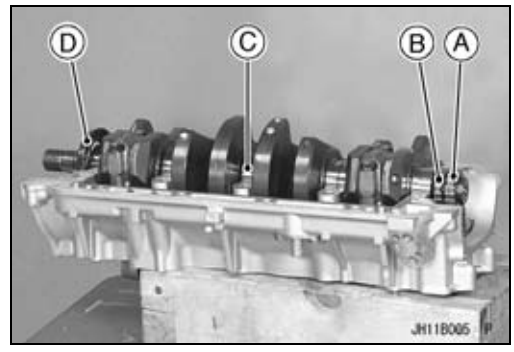


● After tightening all crankcase bolts, check the following item.

○Crankshaft turn freely.

Crankshaft and Connecting Rods

Crankshaft Removal

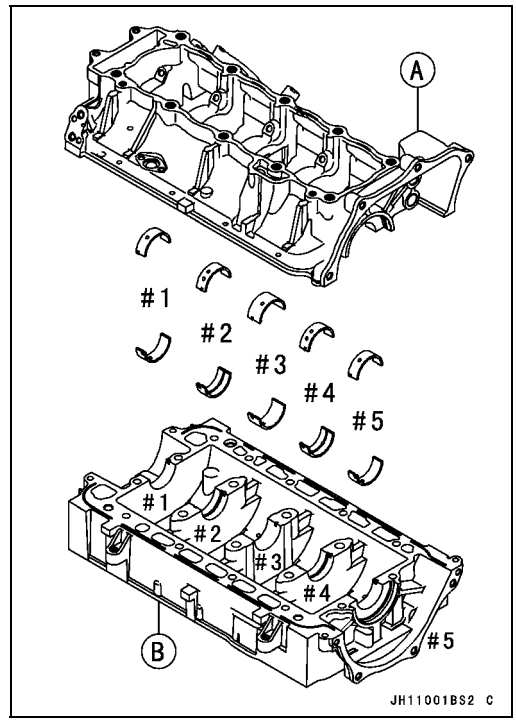


- Split the crankcase (see Crankcase Splitting).
- Remove:
  Camshaft Chain [A]
  Oil Pump Sprocket Chain [B]
- Remove the crankshaft [C] with the oil seal [D].

Crankshaft Installation

CAUTION

If the crankshaft, bearing inserts, or crankcase halves are replaced with new ones, select the bearing inserts and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

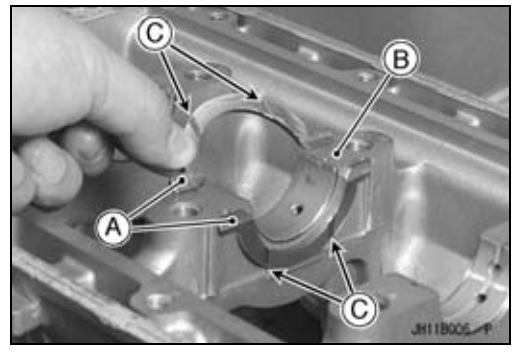


- Fit the crankshaft main bearing inserts on the upper [A] and lower [B] crankcase halves.
  #1, 5 Bearing Inserts (no Groove, same)
  #2, 4 Bearing Inserts (Groove, same)
  #3 Bearing Insert (no Groove)

NOTE

○*Be sure the bearing inserts are seated in the saddles, and the tangs in the bearing inserts are aligned with the notches in the saddles.*

- Apply molybdenum disulfide oil solution to the crankshaft main bearing inserts.

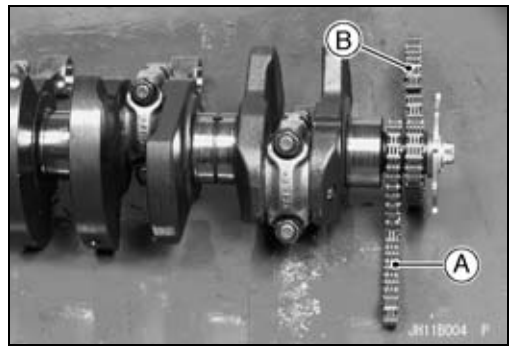


- Fit the thrust washers [A] to both sides of the upper crankcase #3 main bearing [B].

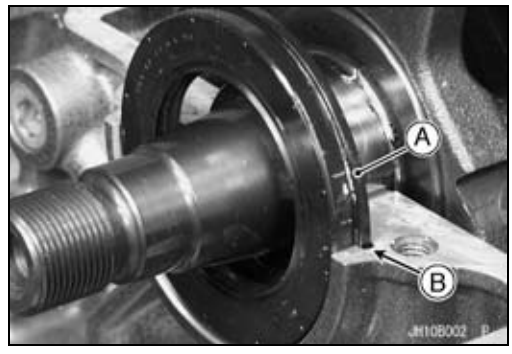
○Install the thrust washer so that the oil grooves [C] face outward.

Crankshaft and Connecting Rods

- Install the crankshaft with the oil pump sprocket chain [A] and camshaft chain [B] hanging on them.



- Fit the oil seal [A] into the groove [B] of the crankcase.
- Assemble the crankcase (see Crankcase Assembly).

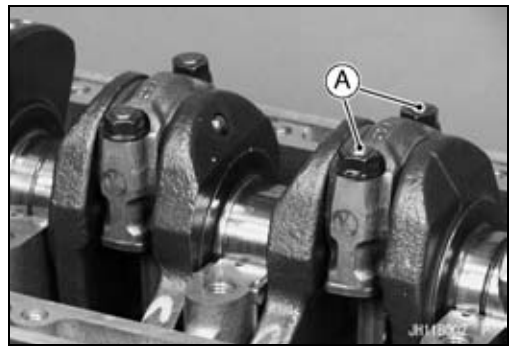


Connecting Rod Removal

- Split the crankcase (see Crankcase Splitting).
- Remove the connecting rod nuts [A].
- Remove the crankshaft.

NOTE

○*Mark and record the locations of the connecting rods and their big end caps so that they can be reassembled in their original positions.*



- Remove the connecting rods from the crankshaft.

Connecting Rod Installation

⚠ WARNING

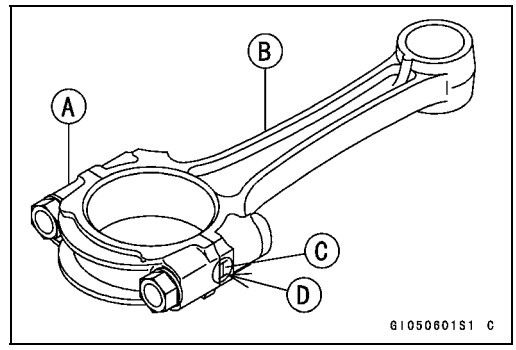
Clean the crankshaft, bolts, nuts, and connecting rods in a well-ventilated area, and take care that there is no spark or flame anywhere near the working area. This includes any appliance with a pilot light. Because of the danger of highly flammable liquids, do not use gasoline or low-flash point solvents to clean them.

- After removing the connecting rods from the crankshaft, clean them with high-flash point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

Crankshaft and Connecting Rods

CAUTION

To minimize vibration, the connecting rods should have the same weight mark.



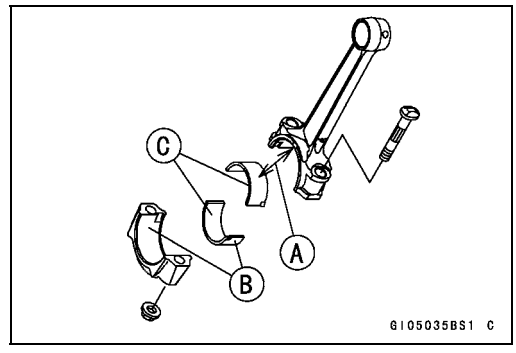
Big End Cap [A]
Connecting Rod [B]
Weight Mark, Alphabet [C]
Diameter Mark [D]

★If the connecting rods, big end bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

CAUTION

The connecting rod bolts are designed to stretch when tightened. Never reuse them. See the table below for correct bolt and nut usage.

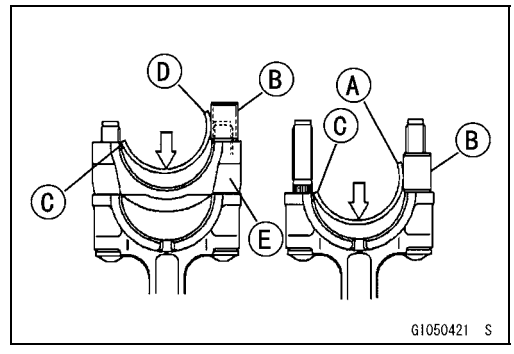
● Apply grease and oil to the following portions.
Apply molybdenum disulfide grease [A].
Do not apply grease and oil [B].
Apply molybdenum disulfide oil solution [C].



CAUTION

Do not apply grease to the inner surface of the lower big end cap or to the outer surface of the lower bearing insert.

● Install the bearing insert as shown to prevent its outer surface from scratch damage with connecting rod edge.
Connecting Rod Side Bearing Insert [A]
Dowel Pin [B]
Claw Side [C]
Cap Side Bearing Insert [D]
Connecting Rod Cap [E]



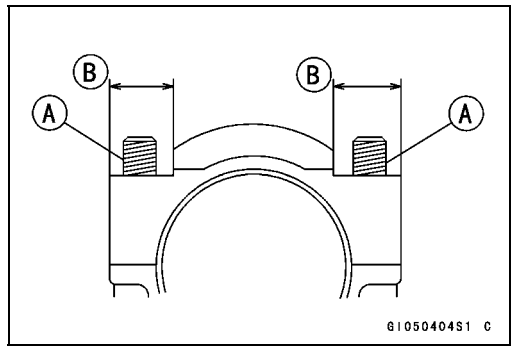
● Replace the connecting rod big end bolts and nuts with new ones.
● Be sure to clean the bolts, nuts, and connecting rods thoroughly with high-flash point solvent, because the new connecting rods, bolts, and nuts are treated with anti-rust solution.

CAUTION

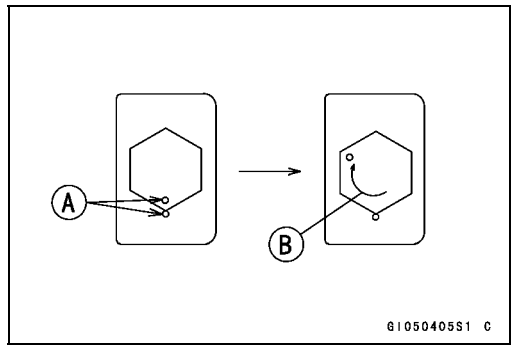
Immediately dry the bolts and nuts with compressed air after cleaning.
Clean and dry the bolts and nuts completely.

Crankshaft and Connecting Rods

● Apply small amount of molybdenum disulfide oil solution to the threads [A] and seating surfaces [B] of the connecting rod nuts.



● First, tighten the nuts to the specified torque. See the table below.
● Next, tighten the nuts by **120°** more.
○Mark [A] the connecting rod big end caps and nuts so that nuts can be turned 120° [B] properly.
○Tighten the hexagon nut by 2 corners.

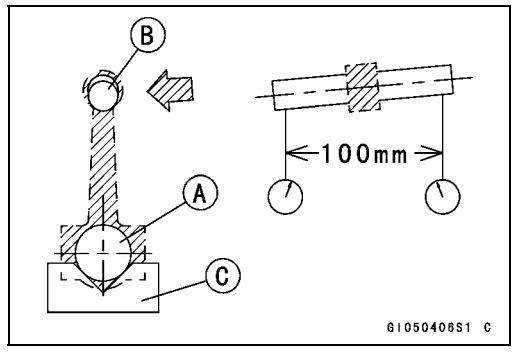


Connecting Rod Assy	Bolt, Nut	Torque + Angle N·m (kgf·m, ft·lb)
New	Use the bolts and nuts attached to new con-rod. Another new bolts and nuts.	21.6 (2.2, 16) + 120°
Used	Replace the bolts and nuts with new ones	21.6 (2.2, 16) + 120°

CAUTION
Be careful not to overtighten the nuts.

Connecting Rod Bend

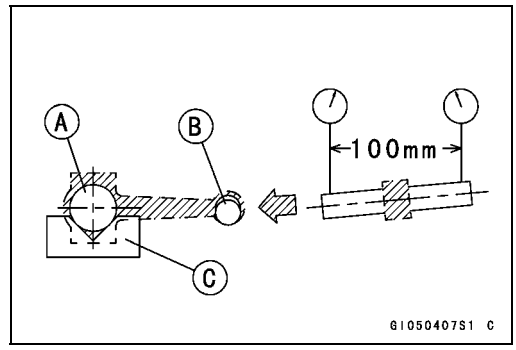
● Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end caps.
● Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
● Select an arbor of the same diameter as the piston pin at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
● On a surface plate, set the big-end arbor on V blocks [C].
● Measure the difference in the heights of the arbor above the surface plate over a 100 mm (3.94 in.) distance-on the arbor to determine the amount of connecting rod bend with the connecting rod held vertically, and using a height gauge.
★If connecting rod bend exceeds the service limit, the connecting rod must be replaced.



Connecting Rod Bend
Service Limit: 0.2/100 mm (0.008/3.94 in.)

Crankshaft and Connecting Rods

Connecting Rod Twist

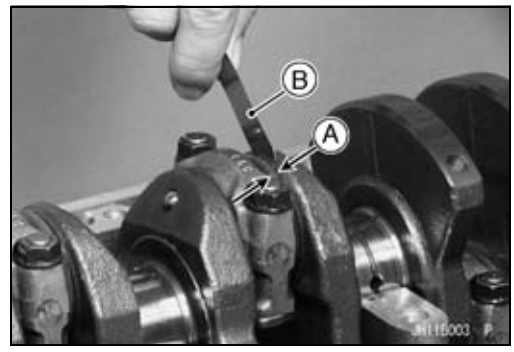


- On surface plate, set the big-end arbor [A] on V block [C].
- Measure the difference in the heights of the arbor [B] above the surface plate over a 100 mm (3.94 in.) distance-on the arbor to determine the amount of connecting rod twist with the connecting rod held horizontally, and using a height gauge.

★If connecting rod twist exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Twist
Service Limit: 0.2/100 mm (0.008/3.94 in.)

Connecting Rod Big End Side Clearance



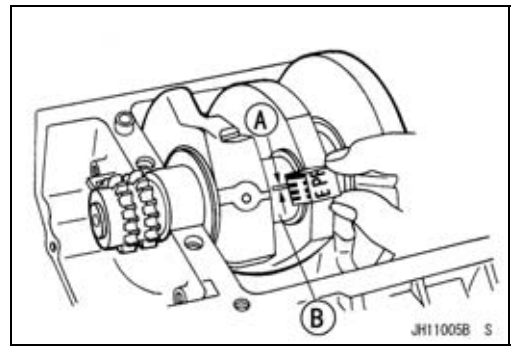
- Measure connecting rod big end side clearance [A].

○Insert a thickness gauge [B] between the big end and either crank web to determine clearance.

Connecting Rod Big End Side Clearance
Standard: 0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)
Service Limit: 0.58 mm (0.023 in.)

★If the clearance exceeds the service limit, replace the connecting rod with a new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.

Connecting Rod Big End Bearing Insert/Crankpin Wear

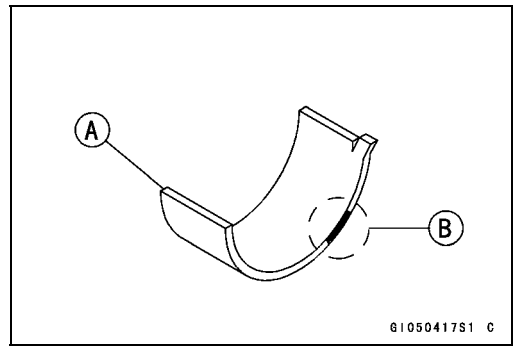


- Measure the bearing insert/crankpin [B] clearance with a plastigage [A].

NOTE

○*Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation).*
○*Do not move the connecting rod and crankshaft during clearance measurement.*

Connecting Rod Big End Bearing Insert/Crankpin Clearance
Standard: 0.041 ~ 0.071 mm (0.0016 ~ 0.00280 in.)
Service Limit: 0.11 mm (0.0043 in.)



★If clearance is within the standard, no bearing replacement is required.

★If clearance is between 0.072 mm (0.00284 in.) and the service limit (0.11 mm, 0.0043 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.

★If the clearance exceeds the service limit, measure the diameter of the crankpins.

Crankpin Diameter
Standard: 38.984 ~ 39.000 mm (1.5348 ~ 1.5354 in.)
Service Limit: 38.97 mm (1.534 in.)

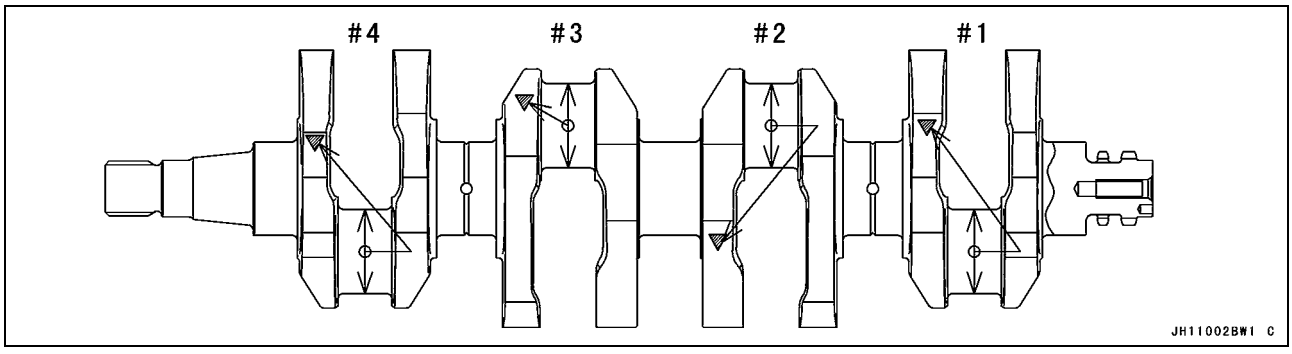
Crankshaft and Connecting Rods

★If any crankpin has worn past the service limit, replace the crankshaft with a new one.
★If the measured crankpin diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

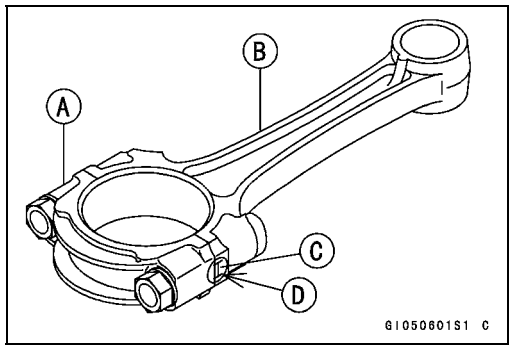
Crankpin Diameter Marks

None	**38.984 ~ 38.992 mm (1.5348 ~ 1.5351 in.)**
○	**38.993 ~ 39.000 mm (1.5352 ~ 1.5354 in.)**

Δ: Crankpin Diameter Marks, "○" mark or no mark.



● Measure the connecting rod big end bore diameter, and mark each connecting rod big end in accordance with the bore diameter.
Big End Cap [A]
Connecting Rod [B]
Weight Mark [C]: A letter of the alphabet
Bore Diameter Mark (Around Weight Mark) [D]: "○" or no mark.



NOTE

○*Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation).*
○*The mark already on the big end should almost coincide with the measurement.*

Connecting Rod Big End Bore Diameter Marks

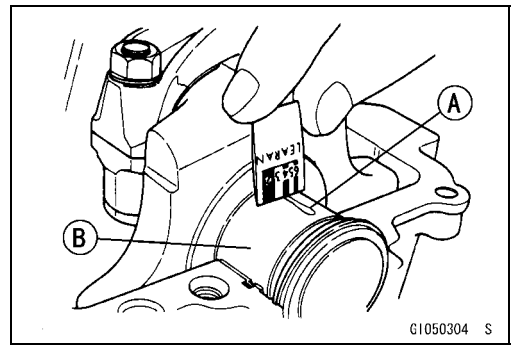
None	**42.000 mm ~ 42.008 mm (1.6535 ~ 1.65386 in.)**
○	**42.009 ~ 42.016 mm (1.65389 ~ 1.6542 in.)**

● Select the proper bearing insert in accordance with the combination coding of the connecting rod and crankshaft.
● Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-3710
None	None	Black	92139-3709
○	○		
○	None	Blue	92139-3708

Crankshaft and Connecting Rods

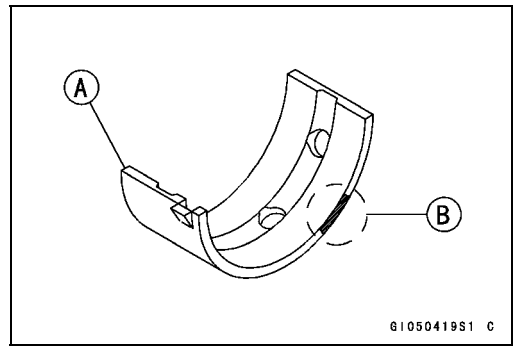
Crankshaft Main Bearing Insert/Journal Wear



- Measure the bearing insert/journal [B] clearance with a plastigage [A].

NOTE

○*Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).*
○*Do not turn the crankshaft during clearance measurement.*
○*Journal clearance less than 0.025 mm (0.0010 in.) can not be measured by plastigage, however, using genuine parts maintains the minimum standard clearance.*



Crankshaft Main Bearing Insert/Journal Clearance
Standard: 0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)
Service Limit: 0.08 mm (0.0032 in.)

★If clearance is within the standard, no bearing replacement is required.
★If clearance is between 0.055 mm (0.022 in.) and the service limit (0.08 mm, 0.0032 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/journal clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
★If clearance exceeds the service limit, measure the diameter of the crankshaft main journal.

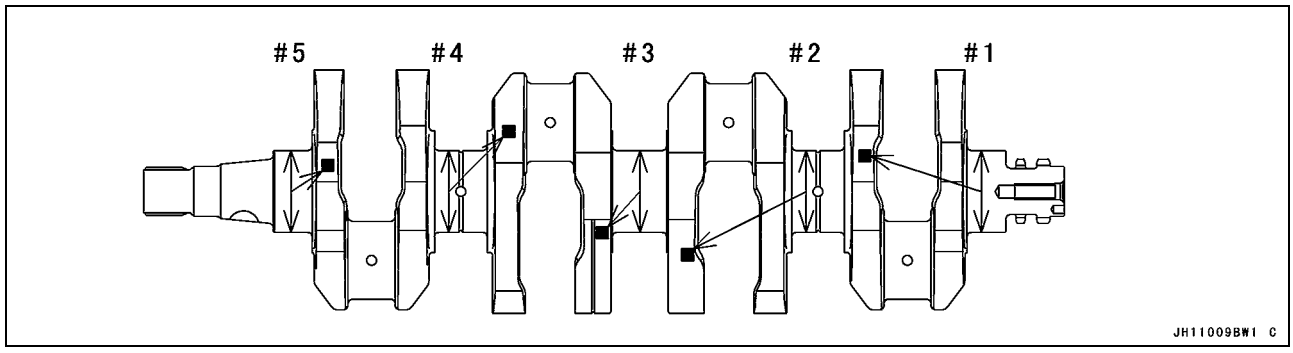
Crankshaft Main Journal Diameter
Standard: 40.984 ~ 41.000 mm (1.6135 ~ 1.6142 in.)
Service Limit: 40.96 mm (1.613 in.)

★If any journal has worn past the service limit, replace the crankshaft with a new one.
★If the measured journal diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

Crankshaft Main Journal Diameter Marks

None	**40.984 ~ 40.992 mm (1.6135 ~ 1.61385 in.)**
1	**40.993 ~ 41.000 mm (1.61389 ~ 1.6142 in.)**

■: Crankshaft Main Journal Diameter Marks, "1" mark or no mark.



Crankshaft and Connecting Rods

- Measure the main bearing bore diameter, and mark [B] the upper crankcase half [A] in accordance with the bore diameter.

○Crankcase main bearing bore diameter marks are "○" mark and no mark.

NOTE

○*Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).*

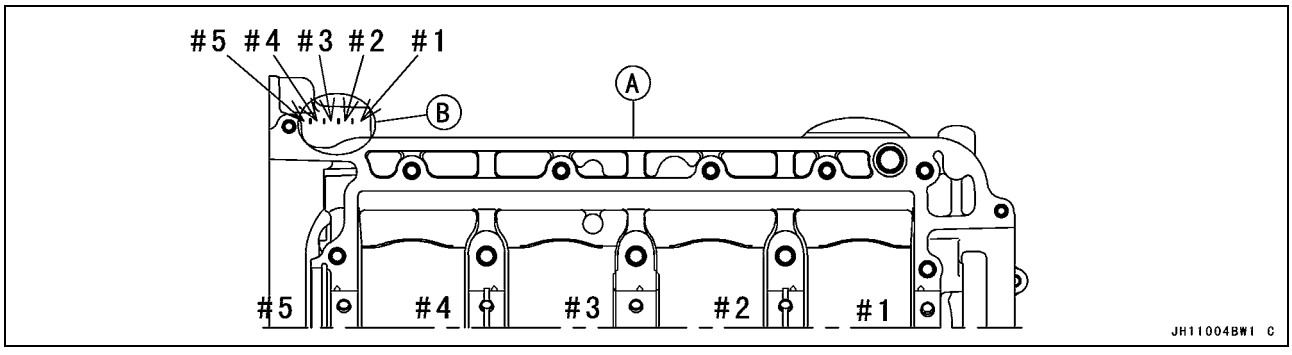
○*The mark already on the upper crankcase half should almost coincide with the measurement.*

Crankcase Main Bearing Bore Diameter Marks

○ 44.000 ~ 44.008 mm (1.7323 ~ 1.73259 in.)

None 44.009 ~ 44.016 mm (1.73263 ~ 1.7329 in.)

Marking Position



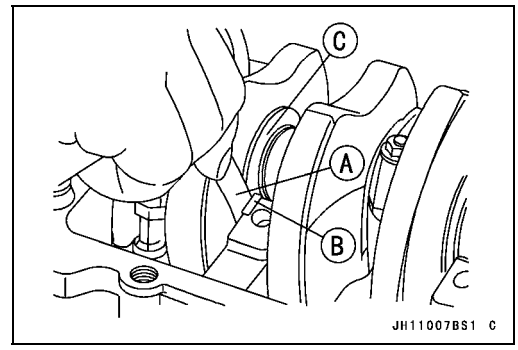
- Select the proper bearing insert in accordance with the combination coding of the crankcase and crankshaft.
- Install the new inserts in the crankcase halves and check insert/journal clearance with the plastigage.

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal No.
○	1	Brown	92139-3704	1, 5
			92139-3713	3
			92139-3707	2, 4
○	None	Black	92139-3703	1, 5
			92139-3712	3
None	1		92139-3706	2, 4
None	None	Blue	92139-3702	1, 5
			92139-3711	3
			92139-3705	2, 4

*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

Crankshaft and Connecting Rods

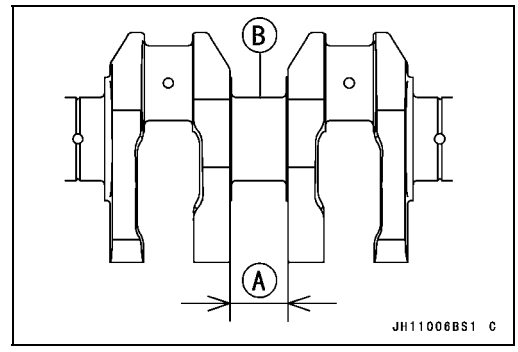
Crankshaft Side Clearance



- Insert a thickness gauge [A] between the thrust washer [B] and the crank web [C] at the No. 3 main journal to determine clearance.

★If the clearance exceeds the service limit, replace the thrust washer as a set and check the width of the crankshaft #3 main journal.

Crankshaft Side Clearance
Standard: 0.05 ~ 0.24 mm (0.0020 ~ 0.0094 in.)
Service Limit: 0.44 mm (0.017 in.)



- Measure the crankshaft #3 main journal width [A].

★If the measurement exceeds the standard, replace the crankshaft [B].

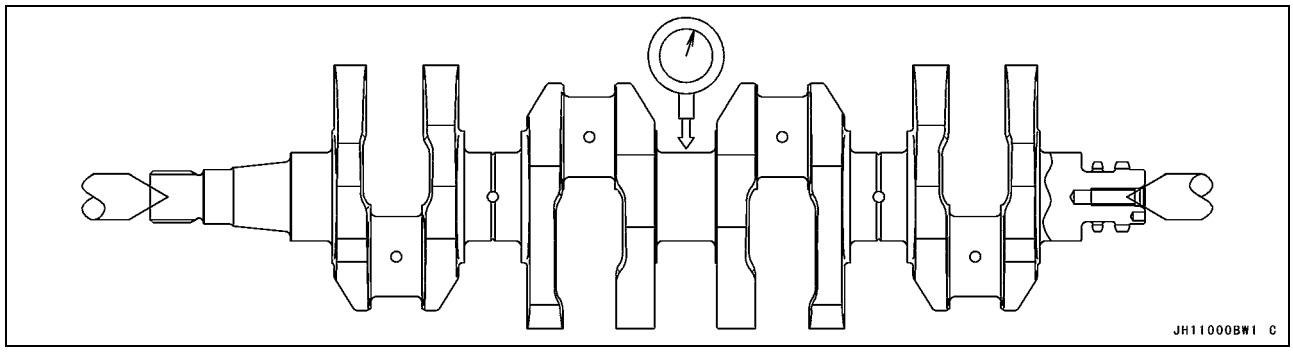
Crankshaft #3 Main Journal Width
Standard: 27.45 ~ 27.55 mm (1.0807 ~ 1.0846 in.)

Crankshaft Runout

- Measure the crankshaft runout.

★If the measurement exceeds the service limit, replace the crankshaft.

Crankshaft Runout
Standard: TIR 0.03 mm (0.0012 in.) or less
Service Limit: TIR 0.07 mm (0.0028 in.)



Cooling and Bilge Systems

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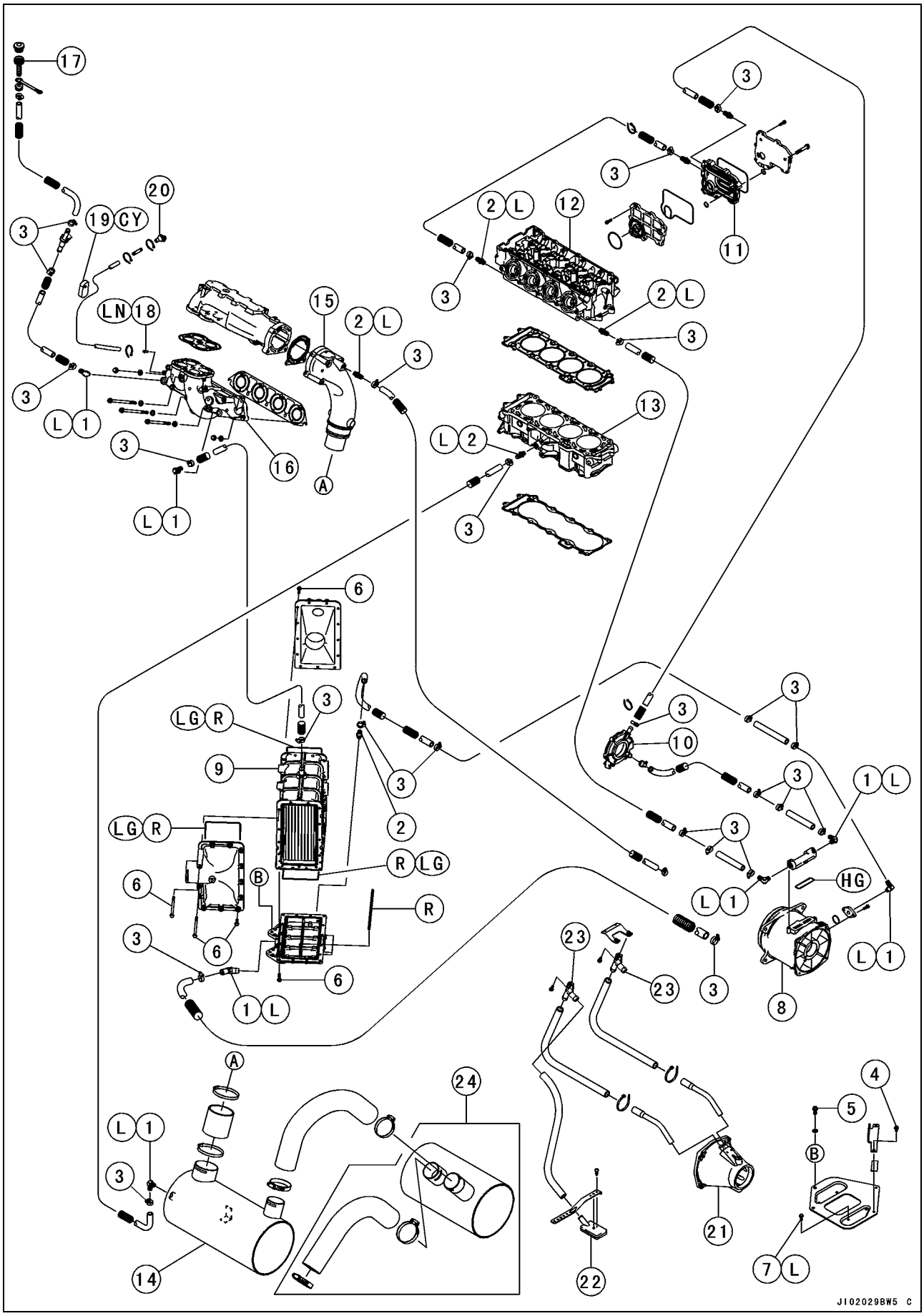
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Water Hose Joint (L Shape Type)	11	1.1	95 in·lb	L
2	Water Hose Joint (Straight Shape Type)	20	2.0	14	L
3	Cooling Hose Clamp Screws	2.5	0.25	22 in·lb	
4	Intercooler Bracket Bolts	7.8	0.80	69 in·lb	
5	Intercooler Mounting Bolts	30	3.1	22	
6	Intercooler Cover Bolts	10	1.0	89 in·lb	
7	Intercooler Plate Bolts	8.8	0.90	69 in·lb	L

8. Pump
9. Intercooler
10. Output Cover
11. Oil Cooler
12. Cylinder Head
13. Cylinder
14. Left Water Box Muffler
15. Muffler Body
16. Exhaust Manifold
17. Flushing Fitting
18. Bypass Joint
19. Detent
20. Bypass Outlet
21. Pump Nozzle
22. Bilge Filter
23. Bilge Breather
24. JT1500B7F Model

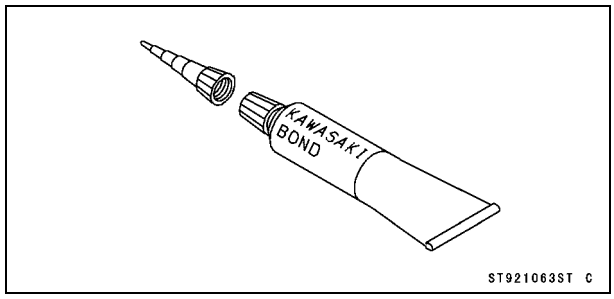
CY: Apply cyanoacrylate cement.
G: Apply grease.
HG: Apply high-grade water-resistance grease (Chevron: Black Pearl Grease EP NLG12 or equivalent).
L: Apply a non-permanent locking agent.
LG: Apply liquid gasket (Kawasaki Bond): 92104-1063
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
R: Replacement Parts

Specifications

Item	Standard
Air Bypass System	
Relief Valve Opening Pressure (Close → Open)	–53.3 ±4 kPa (–0.53 ±0.04 kgf/cm²)
Blow off Valve Opening Pressure (Close → Open)	more than 81 kPa (0.83 kgf/cm²)

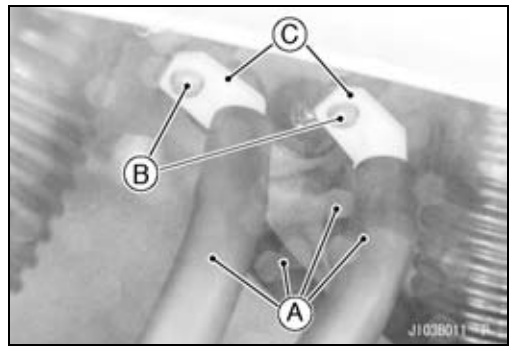
Sealant

Kawasaki Bond (Liquid Gasket - Gray):
92104-1063



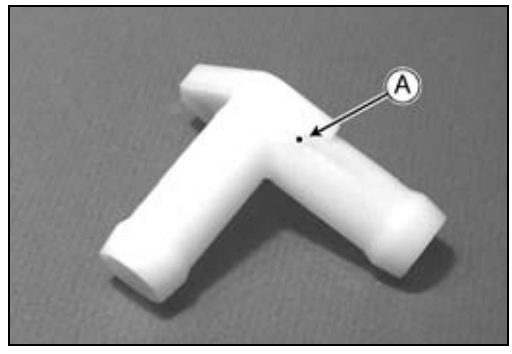
Bilge System

Breather Removal



- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Handrail Plate (see Handrail Plate Removal in the Hull/Engine Hood chapter)
- Pull the hoses [A] off the breather.
- Unscrew the mounting bolts [B], and remove the breathers [C].

Breather Installation



- Be sure the small hole [A] in the breather is open before installing it.
- Apply a non-permanent locking agent to the breather mounting bolts and tighten them.

Breather Cleaning and Inspection

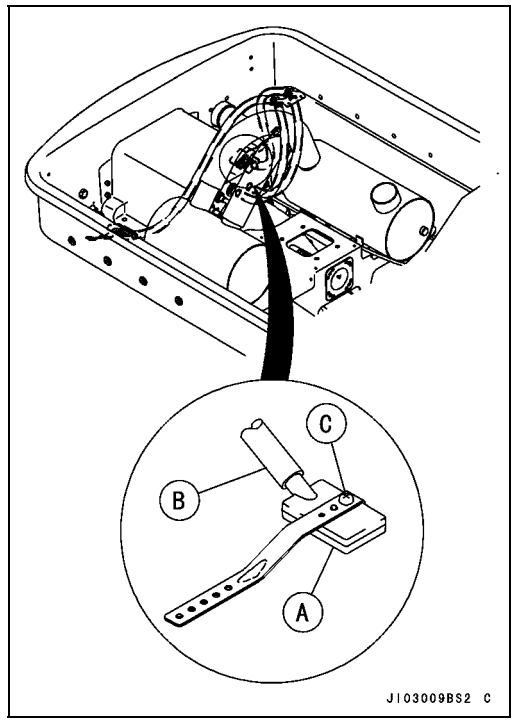
- Check that the small hole in the top of the breather is open by blowing in one end of the breather and plugging the other.

★If the hole is plugged, clean it with compressed air. Do not open it with a pointed object (like a needle or a piece of wire), because the hole may be enlarged. If the hole is too large, the bilge system may not suck water out of the hull as it should.

Filter Removal

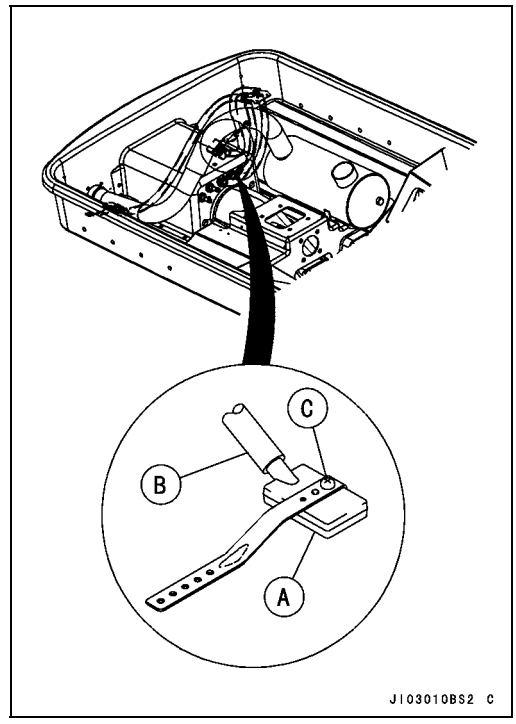
Follow the next procedures to remove the filter [A].

- Remove the engine (see Engine Removal/Installation chapter).
- Pull the hose [B] off the filter.
- Unscrew the mounting screw [C] and remove the filter.



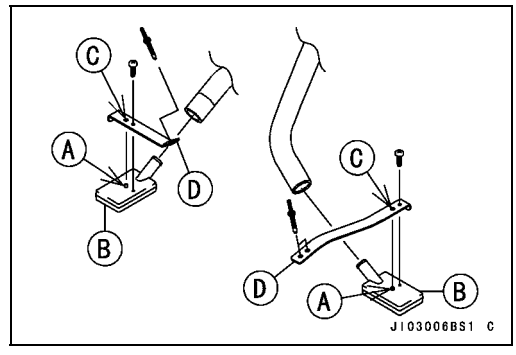
Bilge System

- JT1500B8F Model



Filter Installation

- Align the projections [A] on the filters [B] with the holes [C] on the brackets [D].



Filter Cleaning and Inspection

- Flush the filter thoroughly with fresh water and shake it dry.
- Water must flow freely through the filter, but large debris must not.

★If the filter cannot be cleaned, or if it is broken and allows debris to pass through, replace it.

Cooling and Bilge System Hoses

Hose Removal

- The majority of bilge hoses have no clamps at the hose ends. The majority of bilge system hoses may be simply pulled off their fittings.

NOTE

○*Some of the bilge system hoses have plastic clamps at hose ends.*

- All the cooling system hoses are clamped at both ends. Loosen the clamps and pull the hoses off.

Hose Installation

- To install the bilge filter hose, push the hose over the end of the filter.

NOTE

○*Some of the bilge system hoses have plastic clamps at hose ends.*

- When installing the cooling system hoses, be sure to use the same kind of clamp as the original. Some of the clamps are metal for tighter clamping ability (required when smooth fittings are used). Plastic clamps are used where tight clamping is not required.

Hose Inspection

- Refer to Hose and Hose Connect Inspection in the Periodic Maintenance chapter.

Cooling and Bilge System Flushing

Cooling System Flushing

- Refer to Cooling System Flushing in the Periodic Maintenance chapter.

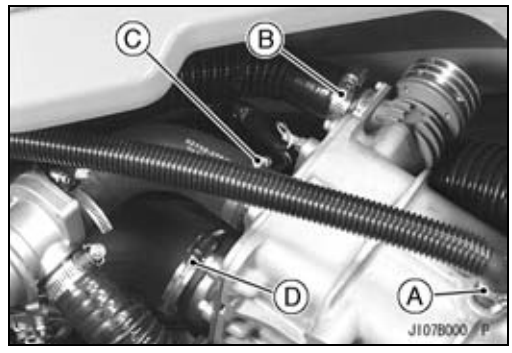
Bilge System Flushing

- Refer to Bilge System Flushing in the Periodic Maintenance chapter.

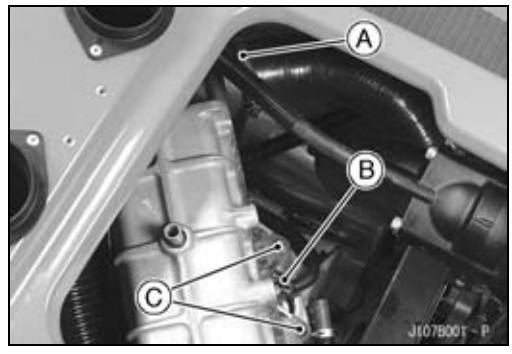
Intercooler

Intercooler Removal

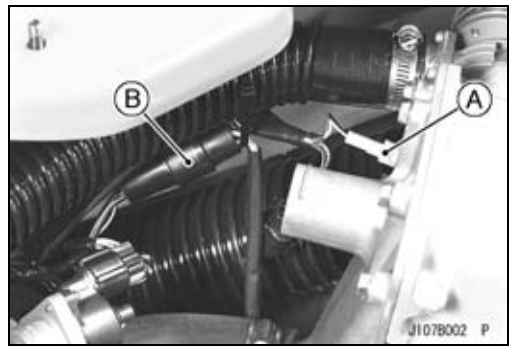
- Remove the oil separator tank (see Oil Separator Tank Removal in the Engine Lubrication System).
- Disconnect:
  Flushing Hose [A] (Exhaust Manifold ~ Intercooler)
  Duct [B] (Blow off Valve ~ Air Box)
  Tube [C] (Relief Valve ~ Intercooler)
  Tube [D] (Intercooler ~Throttle Body)



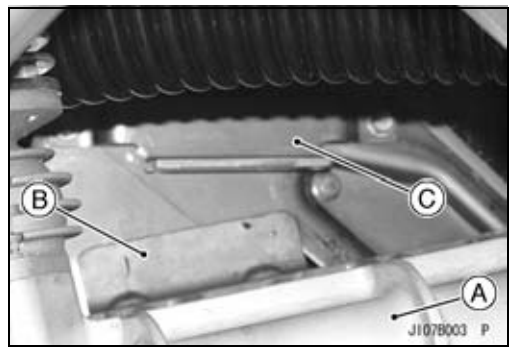
- Disconnect:
  Tube [A] (Supercharger ~ Intercooler)
  Cooling Hose [B] (Intercooler ~ Drain)
- Remove the intercooler bolts [C].



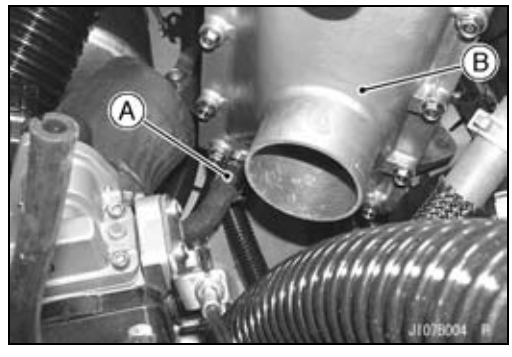
- Disconnect:
  Charging Temperature Sensor Connector [A]
  3-pin Stator Coil Leads Connector [B]



- Move the intercooler [A] to pull the plate [B] of intercooler from the bracket [C].

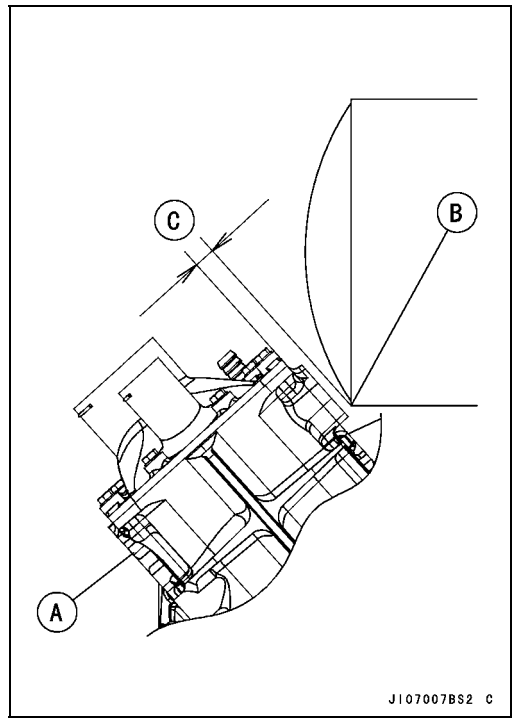


- Disconnect the cooling hose [A] (pump ~ intercooler) and remove the intercooler [B].



Intercooler

Intercooler Installation

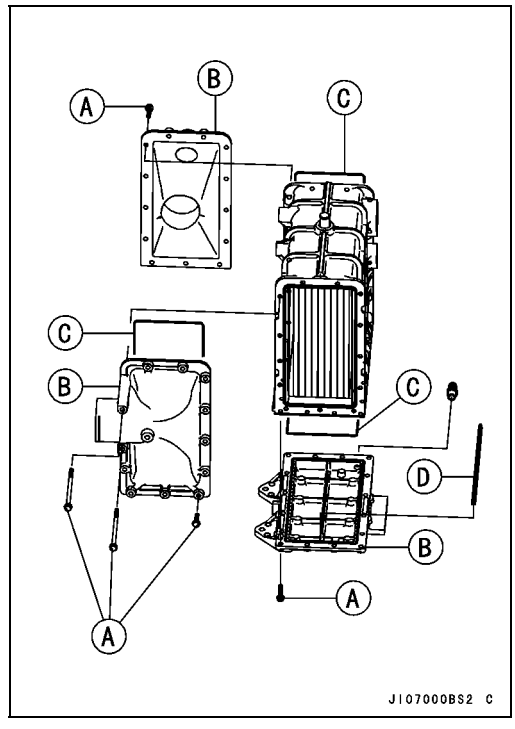


- Keep the clearance between the intercooler [A] and the corner [B] of right water box muffler as shown (JT1500B8F model).
  Clearance [C]: more than 10 mm (0.3937 in.)
- Torque:

  Torque - Intercooler Mounting Bolts: 30 N·m (3.1 kgf·m, 22 ft·lb)

- Route the tubes, ducts and hoses correctly (see Cable, Wire and Hose Routing in the Appendix chapter).

Intercooler Disassembly/Assembly



- Unscrew the intercooler cover bolts [A] and remove the covers [B].

NOTE

○*There are seals between the intercooler case and covers.*

- Remove:
  O-rings [C]
  Gasket [D]

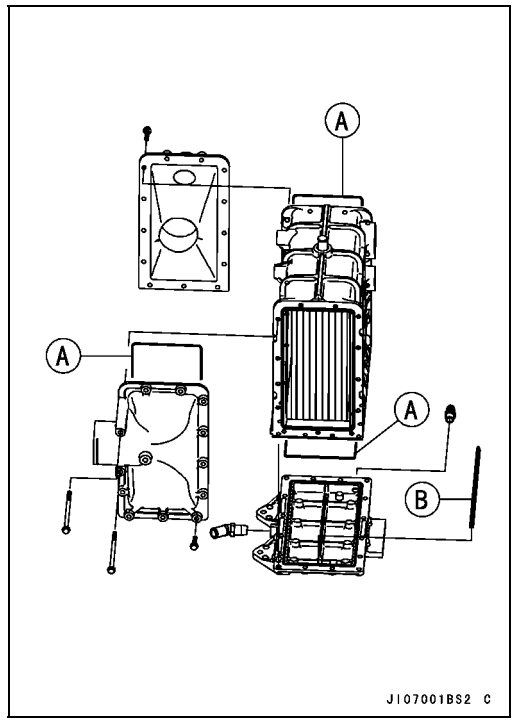
Intercooler

● When assembling, note the following.
○Replace the O-rings [A] and gasket [B] with new ones.
○Apply liquid gasket on the O-rings

Sealant - Kawasaki Bond (Liquid Gasket-Gray): 92104 -1063

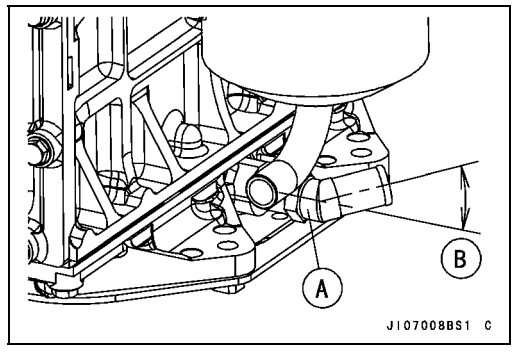
● Torque:

Torque - Intercooler Cover Bolts: 10 N·m (1.0 kgf·m, 89 in·lb)



○Apply a non-permanent locking agent to the water hose joint.
○Tighten and set the water hose joint [A] at an angle of 15° [B] from the horizontal plane as shown in the figure.

Torque - Water Hose Joint (L Shape Type): 11 N·m (1.1 kgf·m, 95 in·lb)



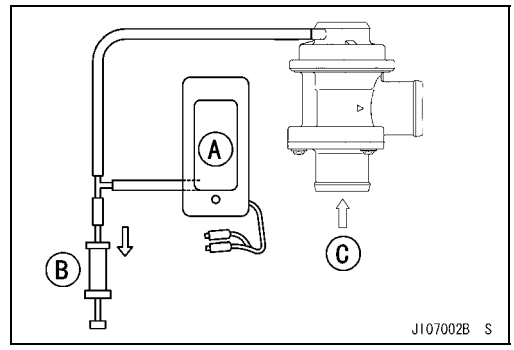
Air Bypass System

Relief Valve Inspection

● Connect a vacuum gauge [A] and syringe [B] or fork oil level gauge to the vacuum hoses as shown.

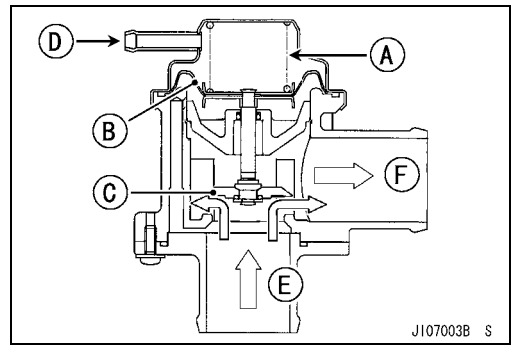
Special Tools - Fork Oil Level Gauge: 57001-1290

Air Flow [C]



● Gradually raise the vacuum (lower the pressure) applied to the relief valve, and check the valve operation. When the vacuum is high, the relief valve should permit air to flow. When the vacuum lowers to valve closing pressure, it should stop air flow.

Spring [A]
Diaphragm [B]
Valve [C]
High Vacuum [D]
Compressed Air Flow [E]
To Air Box [F]

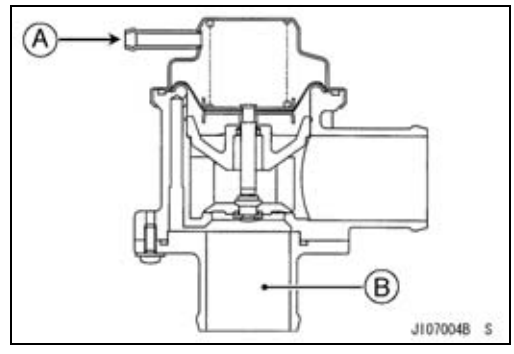


★If the relief valve does not operate as described, replace it with a new one.

Low Vacuum [A]
Compressed air can not flow [B]

NOTE

○*If the portion of B is in atmospheric pressure, the portion of A becomes negative pressure. The standard of the above relief valve opening pressure can be calcurated by the following.*
Standard = Negative Pressure (Portion of A) – Atmospheric Pressure (Portion of B)

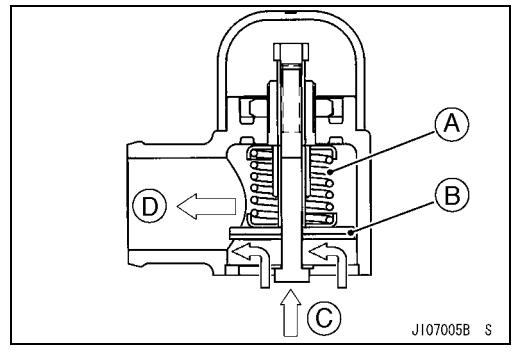


Relief Valve Opening Pressure (Close → Open)
Standard: –53.3 ±4 kPa (–0.53 ±0.04 kgf/cm²)

Blow off Valve Inspection

● Gradually raise the pressure applied to the blow off valve, and check the valve operation. When the pressure is low, the blow off valve should not permit air to flow. When the pressure raises to valve opening pressure, it should permit air flow.

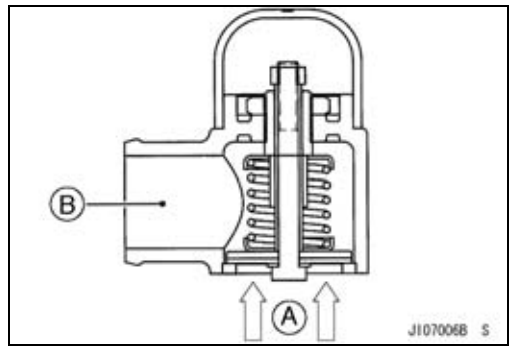
Spring [A]
Valve [B]
High Compressed Air [C]
Air Flow [D]



Air Bypass System

★If the blow off valve does not operate as described, replace it with a new one.

Blow off Valve Opening Pressure (Close → Open)
Standard: more than 81 kPa (0.83 kgf/cm²)
Low Compressed Air [A]
Air Cannot Flow [B]

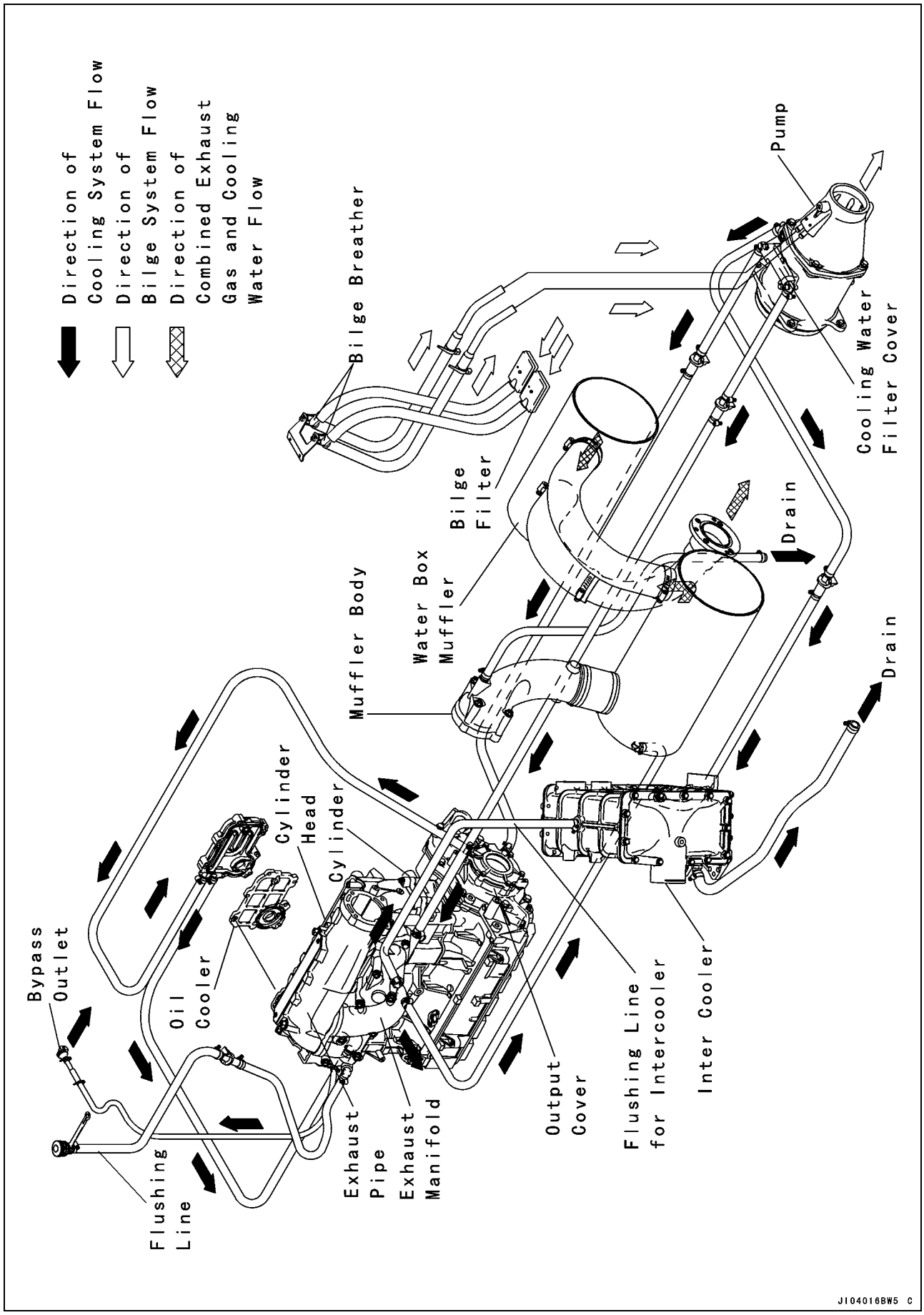


NOTE

○*If the portion of B is in atomospheric pressure, the portion of A becomes charging pressure. The standard of the above blow off valve opening pressure can be calcurated by the following.*
Standard = Charging Pressure (Portion of A) – Atmospheric Pressure (Portion of B)

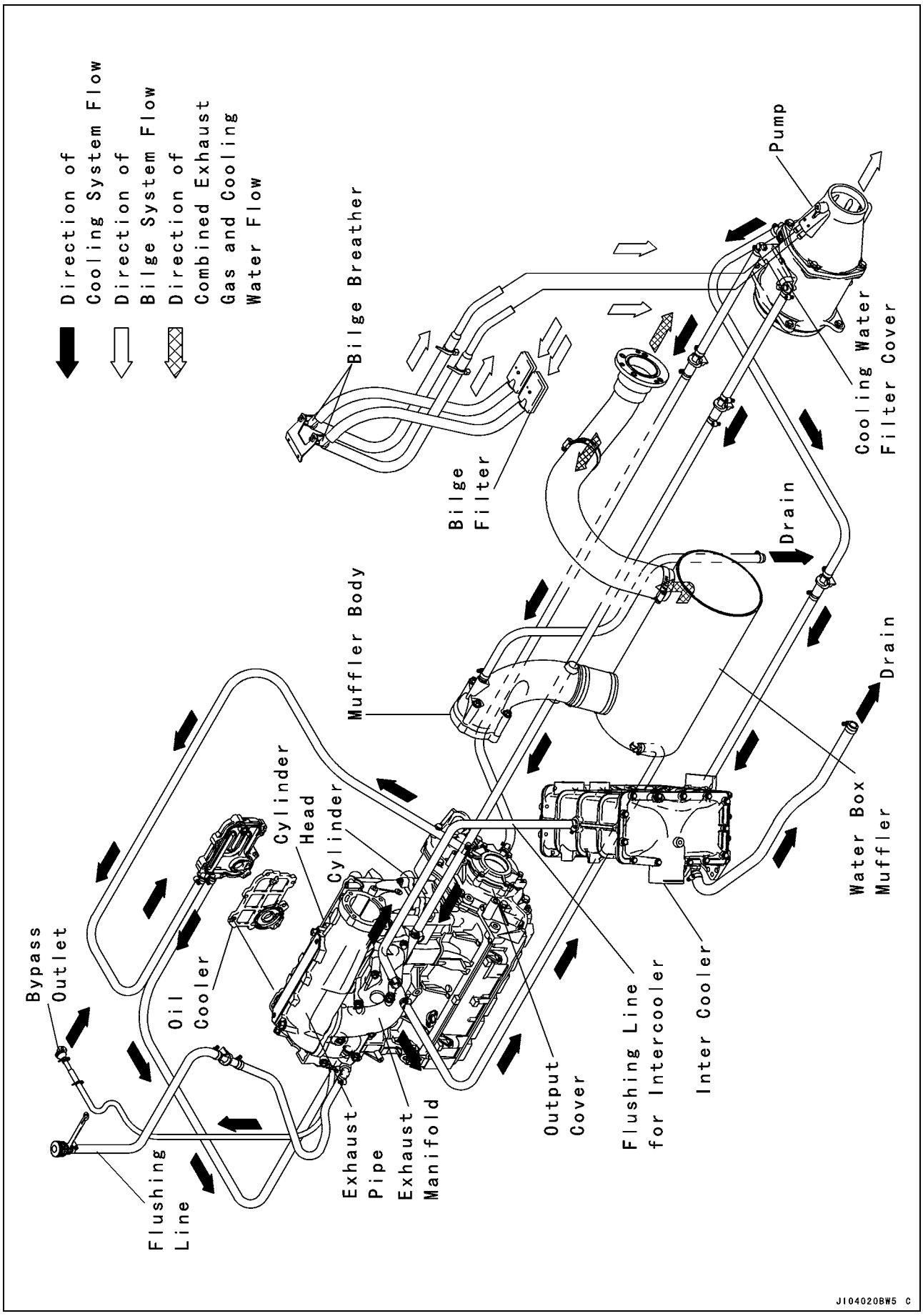
Cooling and Bilge System Flow Diagram

JT1500B7F



Cooling and Bilge System Flow Diagram

JT1500B8F



After Submerging

CAUTION

Do not operate the watercraft with water in the engine.
Do not try to start the engine until it is completely empty of water; internal engine parts could be severely and immediately damaged. If water gets into the engine, follow this procedure immediately! If water is left in the engine more than a few hours, it will destroy the crankshaft bearings and damage other internal engine parts.

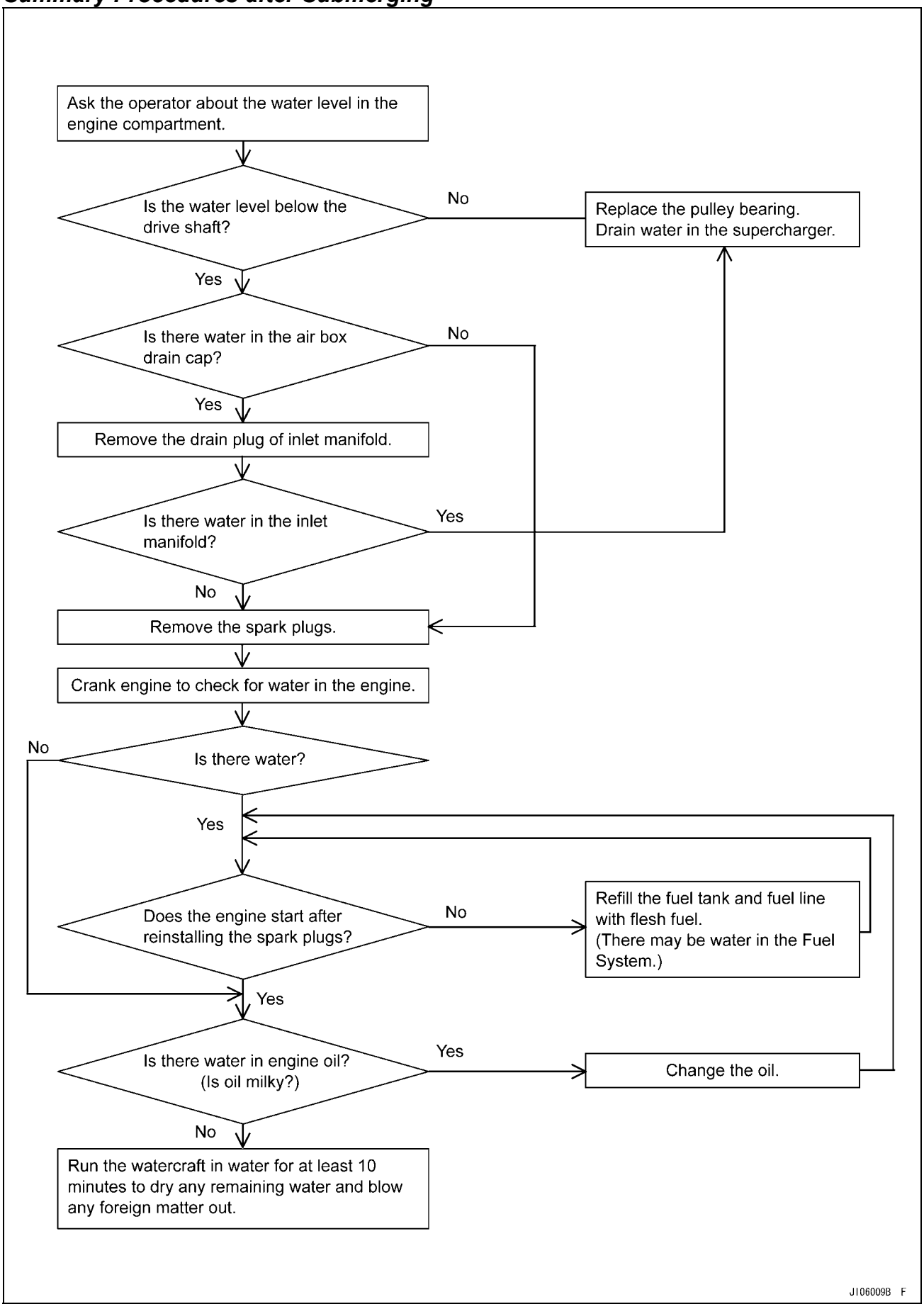
If the watercraft becomes swamped, water may enter the engine and the supercharger. Water may also enter the fuel tank.

The following procedures explain the necessary steps you must provide.

Read the summary of the procedure first and then their detailed procedures carefully.

After Submerging

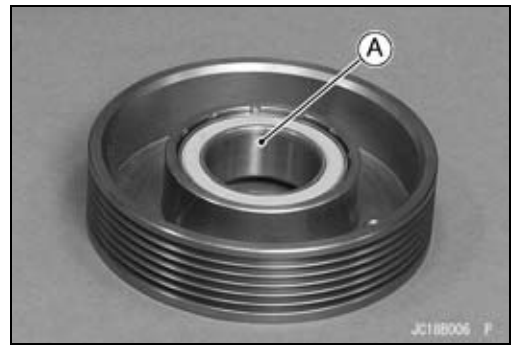
Summary Procedures after Submerging

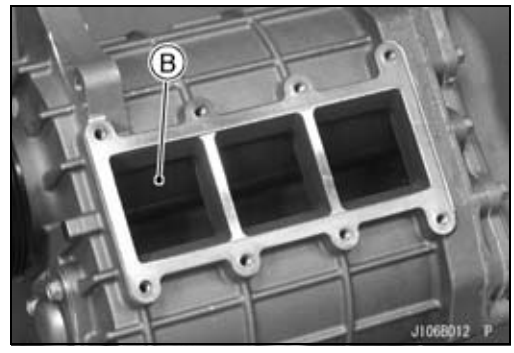

Ask the operator about the water level in the engine compartment.
Is the water level below the drive shaft?
No
Replace the pulley bearing.
Drain water in the supercharger.
Yes
Is there water in the air box drain cap?
No
Yes
Remove the drain plug of inlet manifold.
Is there water in the inlet manifold?
Yes
No
Remove the spark plugs.
Crank engine to check for water in the engine.
Is there water?
No
Yes
Does the engine start after reinstalling the spark plugs?
No
Refill the fuel tank and fuel line with flesh fuel.
(There may be water in the Fuel System.)
Yes
Is there water in engine oil?
(Is oil milky?)
Yes
Change the oil.
No
Run the watercraft in water for at least 10 minutes to dry any remaining water and blow any foreign matter out.
J106009B F

After Submerging

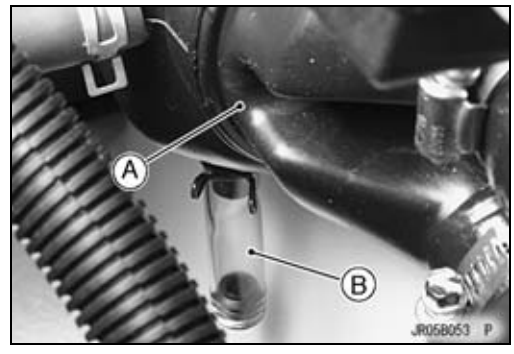
Detailed Procedures after Submerging

1. Ask the operator about the water level in the engine compartment.
2. If the drive shaft is already submerged, drain the water from the drain screws at the stern. Replace the pulley [A] bearing (pulley assembly) and drain water in the supercharger [B] (see Supercharger Disassembly and Assembly in the Fuel (DFI) System chapter).

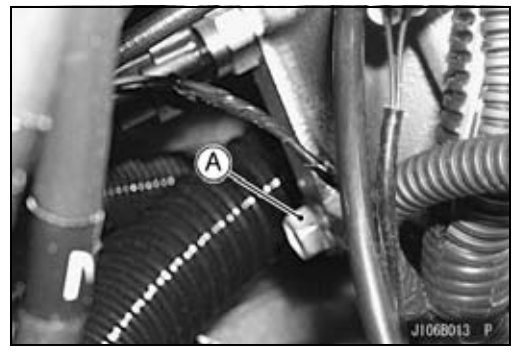




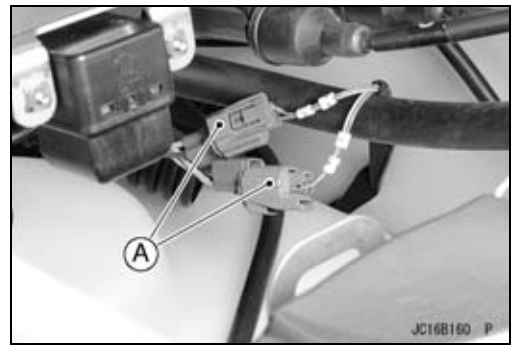
3. If the water level is below the drive shaft, drain the water from the drain screws and proceed the work in the following manners.
4. Check the drain cap [B] at the bottom of air box [A].



5. If there is water, drain water in the supercharger (see Supercharger Disassembly and Assembly in the Fuel (DFI) System chapter) since there is a great possibility that water has entered the supercharger and the engine.
   Also, remove the drain plug [A] on the inlet manifold and check that there is water in the inlet manifold. If there is water, drain water in the supercharger (see Supercharger Disassembly and Assembly in the Fuel (DFI) System chapter).



6. If there is no water in the air box and inlet manifold, continue the following steps.
7. Disconnect the two connectors [A] on the primary ignition leads located at the right front of the engine



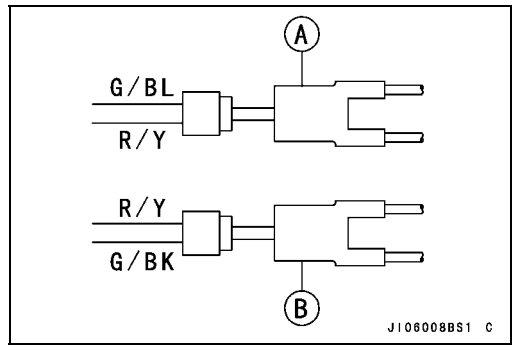
After Submerging

8. Pull and remove all the spark plug caps.
9. Remove all spark plugs.
10. Insert the ignition switch key, push the lanyard key under the stop button, and push the start button.
11. If there is water in the engine, it will be pumped out from the plug holes, discharge the water. Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.

⚠ WARNING

Do not lean over the engine when performing this procedure. A water and gasoline mixture will be forcibly ejected from the spark plug holes and could get into your eyes. If you do get some in your eyes, wash your eyes immediately with liberal amounts of clean, fresh water. Consult a physician as soon as possible.

12. If there is no water coming out of the engine, spray the spark plugs clean with air and then restore them with their plug caps.
13. Reconnect the primary ignition lead connectors.
14. Reconnect the primary ignition coil lead connectors, noting the #1,#4 [A] and the #2, #3 [B] coil connectors. The #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.



NOTE

○ *The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).*

15. Start the engine by pressing the start button and run less than 15 seconds.

CAUTION

Do not run the engine with the watercraft out of water for more than 15 seconds at a time. Overheating will cause severe engine and exhaust system damage.
Never operate the engine at maximum speed out of water. Severe engine damage may occur.

After Submerging

16. Remove the dipstick and check for the water presence in the engine oil. (If there is water in, oil looks milky.)
17. If the oil looks milky, then change the oil and repeat items 15 & 16 until the oil does not turn milky any more.
18. If the engine doe not start, there may be water in the fuel system.
19. If the fuel tank has water in it, it must be emptied with pump or siphon. Refill the tank with fresh fuel. Dispose of the contaminated fuel at an appropriate hazardous waste site.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke.
Make sure the area is well-ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

⚠ WARNING

Gasoline is a toxic substance. Dispose of gasoline properly. Contact your local authorities for approved disposal methods.

20. Continued trouble may require cleaning of the fuel line to drain water.

21. Open the front storage lid, remove the storage case and check for water in the storage compartment. If necessary, drain the water from the drain plug [A] at the bottom. Also remove the battery cover [B] and check the battery condition.

22. Reinstall the seats and secure them.
23. Reinstall the drain screws in the stern.
24. Finally run the watercraft IN WATER for at least 10 minutes to dry any remaining water and blow any foreign matter (like salt) out through the exhaust.

Drive System

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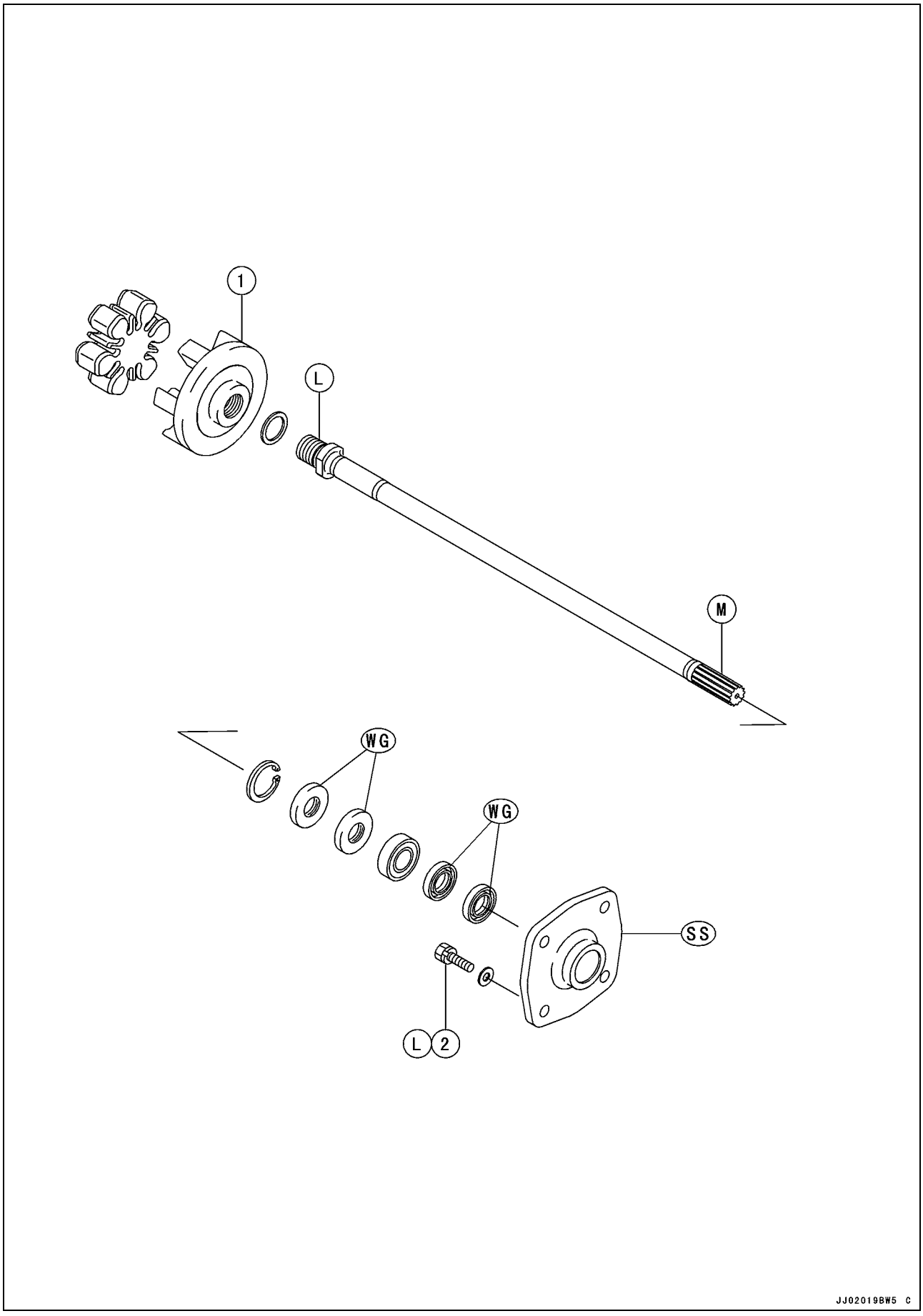
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Coupling	39	4.0	29	
2	Drive Shaft Holder Mounting Bolts	22	2.2	16	L

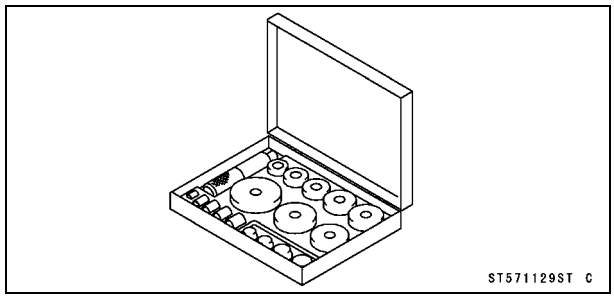
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
SS: Apply silicone sealant.
WG: Apply water resistance grease.

Specification

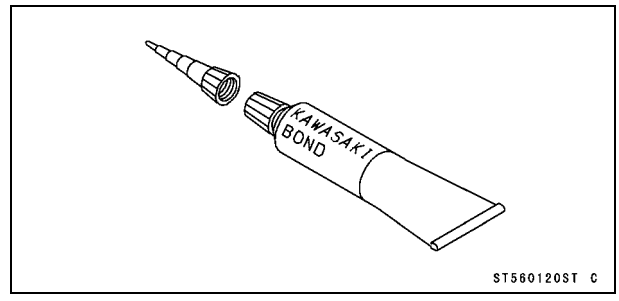
Item	Standard	Service Limit
Drive Shaft		
Runout (see P10-8)	[A] Less than 0.1 mm (0.0039 in.) [B] Less than 0.2 mm (0.0079 in.)	0.2 mm (0.0079 in.) 0.6 mm (0.0236 in.)

Special Tools and Sealant

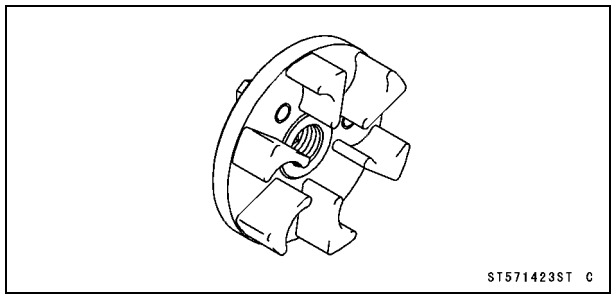
Bearing Driver Set:
57001-1129



Kawasaki Bond (Silicone Sealant):
56019-120



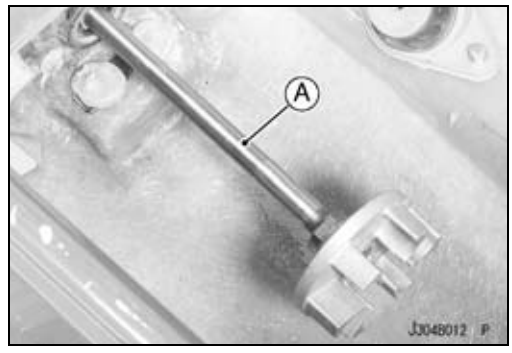
Coupling Holder #2:
57001-1423



Drive Shaft/Drive Shaft Holder

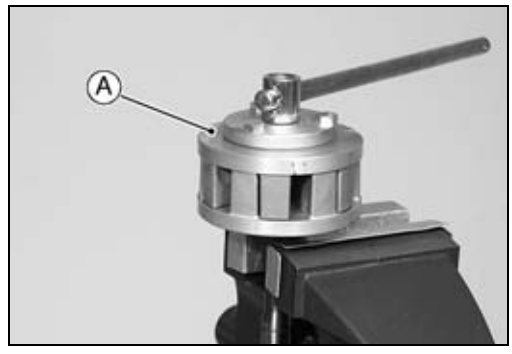
Drive Shaft Removal/Installation

- Remove the engine (see Engine Removal/Installation chapter).
- Pull the drive shaft [A] out of the hull.



- Hold the drive shaft in a vice, and unscrew the coupling.

  Special Tool - Coupling Holder: 57001-1423 [A]



- When installing the drive shaft, be careful of the following items.

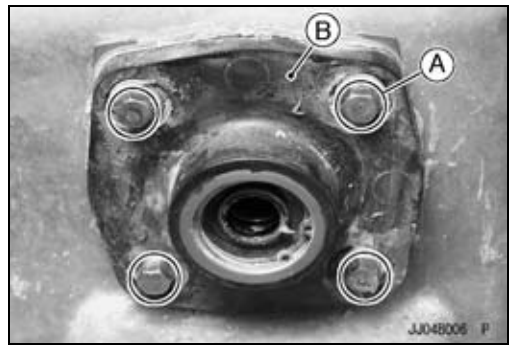
○Apply a non-permanent locking agent to the coupling threads and tighten it.

Torque - Coupling: 39 N·m (4.0 kgf·m, 29 ft·lb)

○Apply grease to the grease seal lips and the drive shaft spline.

Drive Shaft Holder Removal/Disassembly

- Remove the drive shaft.
- Unscrew the mounting bolts [A] and remove the drive shaft holder [B] from the bulkhead.

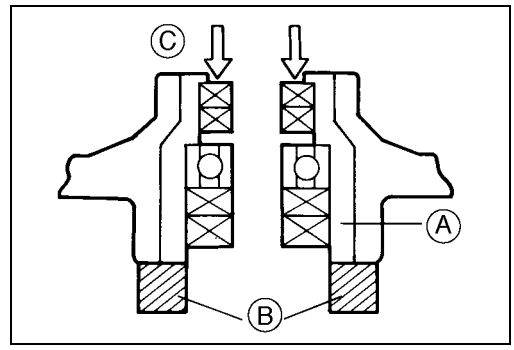


- Disassemble the drive shaft holder.

○Remove the circlip [A].

Drive Shaft/Drive Shaft Holder

○Press the small grease seal, and the large grease seals, bearing, and small grease seals come out of the holder.
[A] Sleeve
[B] Blocks
[C] Press



Drive Shaft Holder Assembly/Installation

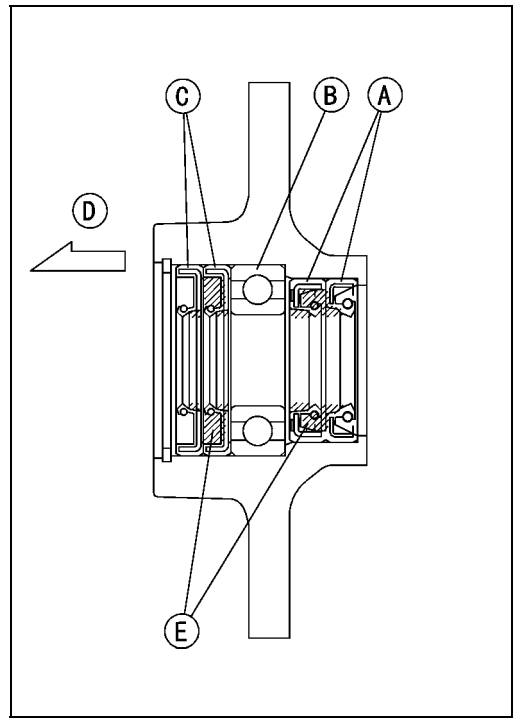
- Replace the grease seals with new ones.
- Press the bearing and grease seals into the drive shaft holder, noting the following.

○Install the parts in this order.
Two Small Grease Seals [A]
One Bearing [B]
Two Large Grease Seals [C]
Front [D]

Special Tool - Bearing Driver Set: 57001-1129

○Install the seals so that the sides with the spring face outward.
○Fill the gaps between the seals with water resistance grease [E].

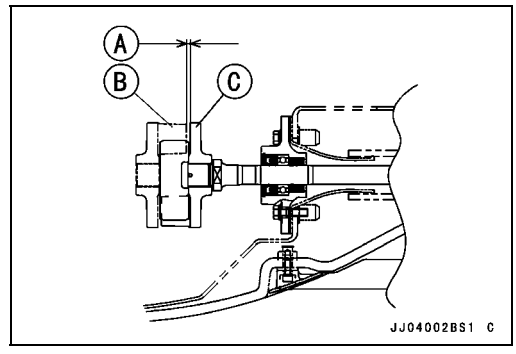
- Install the circlip.
- Apply water resistance grease to the bearing inner surface and grease seal lips.



- Install the drive shaft holder on the bulkhead so that the circlip side face toward the front.
- Apply a non-permanent locking agent to the drive shaft holder mounting bolts, tighten them loosely.
- Install the drive shaft.
- After installing the engine, tighten the drive shaft holder mounting bolts to the specified torque to give proper coupling alignment.

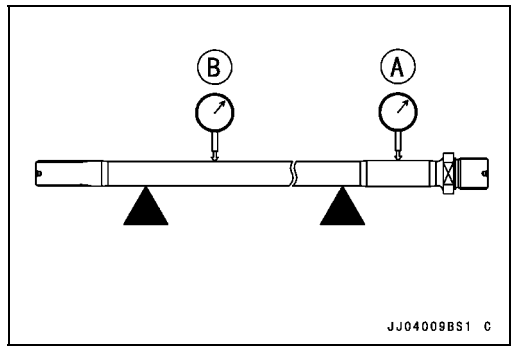
Torque - Drive Shaft Holder Mounting Bolts: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Make sure the clearance [A] between the engine coupling [B] and the drive shaft coupling [C] is 3 ~ 5 mm (0.12 ~ 0.20 in.).



Drive Shaft/Drive Shaft Holder

Drive Shaft Runout



- Measure drive shaft runout by supporting the shaft on V blocks and setting a dial gauge against the shaft at each point shown.
- Turn the drive shaft slowly. The difference between the highest and lowest dial gauge reading is the runout.

★If any measurement exceeds the service limit, replace the shaft.

Drive Shaft Runout

Standard:	**Less than 0.1 mm (0.0039 in.) [A]**
	Less than 0.2 mm (0.0079 in.) [B]
Service Limit:	**0.2 mm (0.0079 in.) [A]**
	0.6 mm (0.0236 in.) [B]

Pump and Impeller

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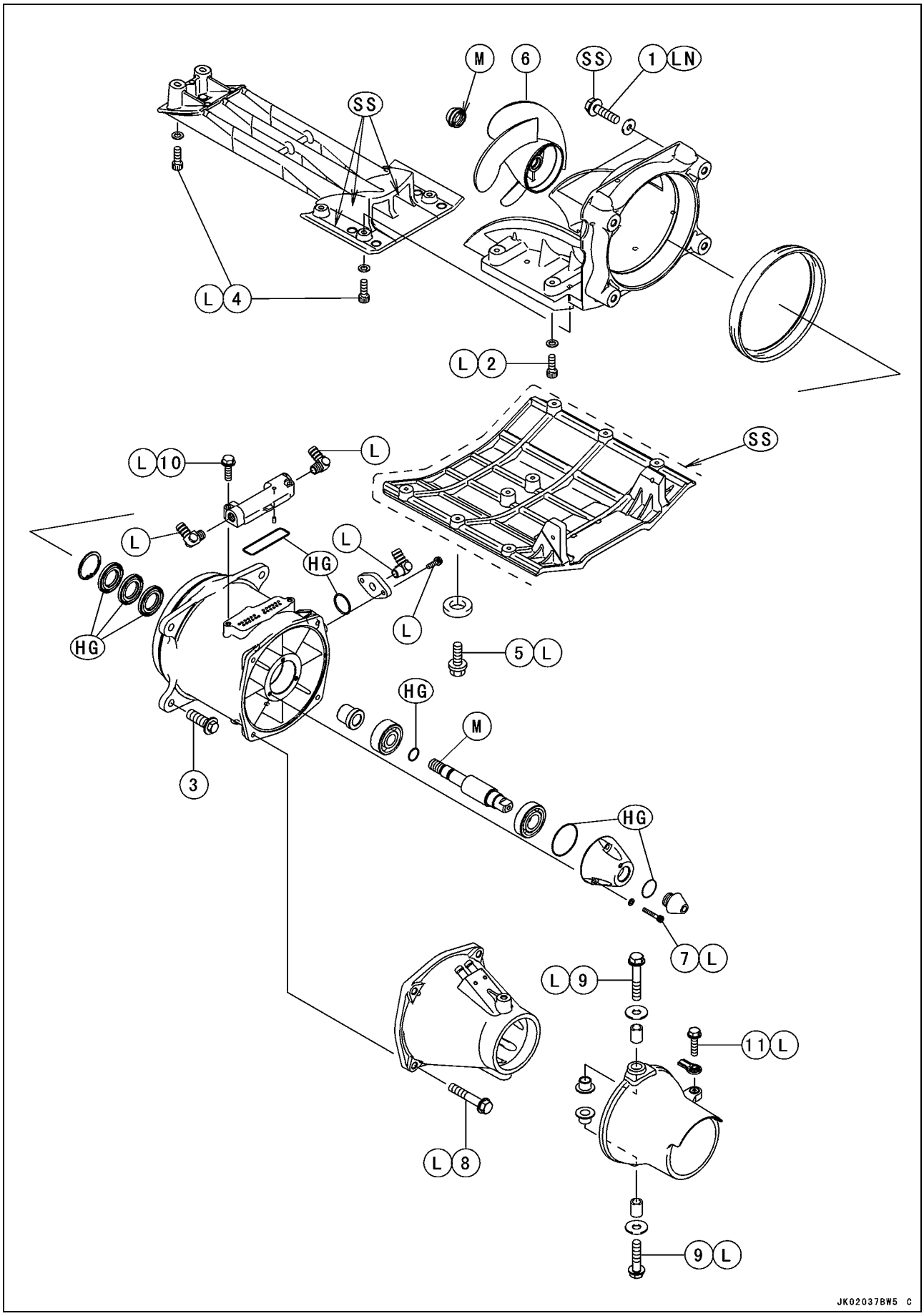
Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Pump Bracket Mounting Bolts (2)	19	1.9	14	LN, SS
2	Pump Bracket Mounting Bolts (4)	9.8	1.0	87 in·lb	L
3	Pump Mounting Bolts	36	3.7	27	L
4	Grate Mounting Bolts	9.8	1.0	87 in·lb	L
5	Pump Cover Mounting Bolts	7.8	0.80	69 in·lb	L
6	Impeller	98	10	72	
7	Pump Cap Bolts	3.9	0.4	35 in·lb	L
8	Pump Outlet Mounting Bolts	19	1.9	14	L
9	Steering Nozzle Pivot Bolts	19	1.9	14	L
10	Filter Cover Mounting Bolts	9.8	1.0	87 in·lb	L
11	Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L

HG: Apply high grade water resistance grease (Chevron: Black Pearl Grease EP NLGI 2 or equivalent).
L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
M: Apply molybdenum disulfide grease.
SS: Apply silicone sealant.

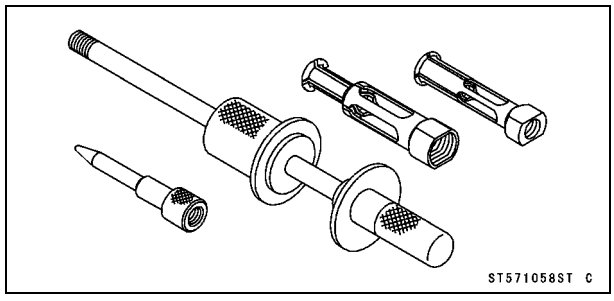
11-4 PUMP AND IMPELLER

Specifications

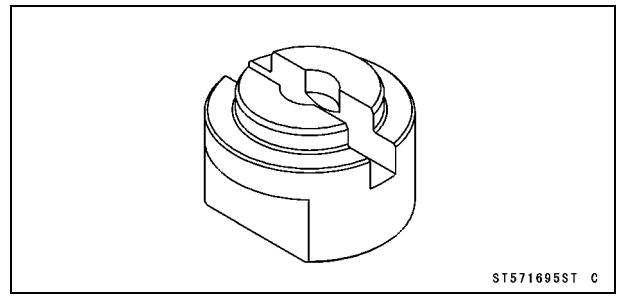
Item	Standard	Service Limit
Jet Pump		
Impeller Outside Diameter	154.5 ~ 154.7 mm (6.0827 ~ 6.0905 in.)	153.5 mm (6.0433 in.)
Pump Case Inside Diameter	155.0 ~ 155.1 mm (6.1024 ~ 6.1063 in.)	156.1 mm (6.1457 in.)
Impeller Clearance	0.15 ~ 0.3 mm (0.0059 ~ 0.0118 in.)	0.6 mm (0.0236 in.)

Special Tools and Sealant

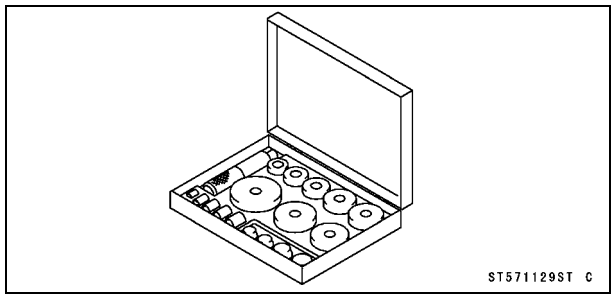
Oil Seal & Bearing Remover:
57001-1058



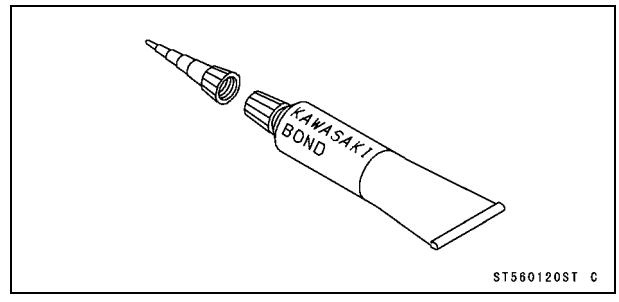
Impeller Holder:
57001-1695



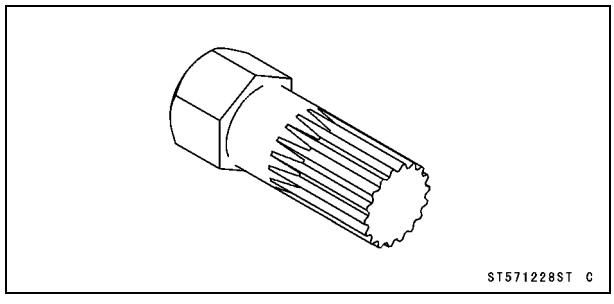
Bearing Driver Set:
57001-1129



Kawasaki Bond (Silicone Sealant):
56019-120



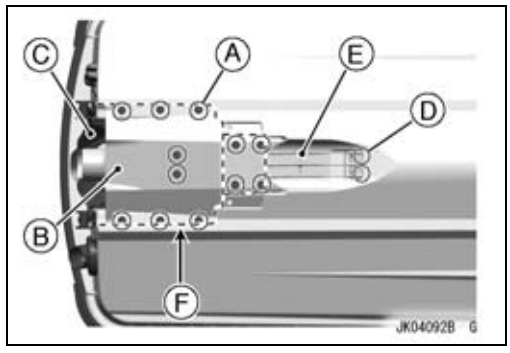
Impeller Wrench:
57001-1228



Pump and Impeller

Pump Removal

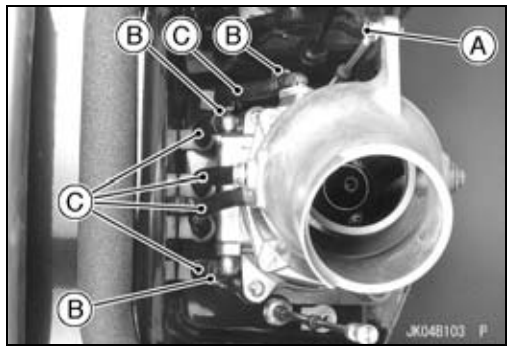
- Turn the craft on its left side.
- Disconnect the reverse cable ball joint at the rear end.
- Unscrew the pump cover mounting bolts [A], and remove the pump cover [B] with the reverse bracket [C].
- Unscrew the grate mounting bolts [D] and remove the grate [E].



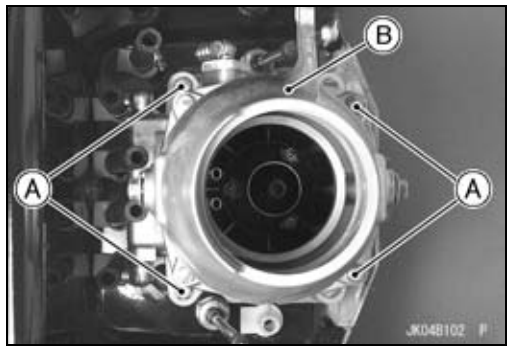
NOTE

○*Cut the sealant at the indicated area [F] in the figure.*

- Remove the joint bolts [A] and take off the steering cable joint.
- Loosen the clamps [B] on the inlet cooling hose, and pull off the hoses [C].

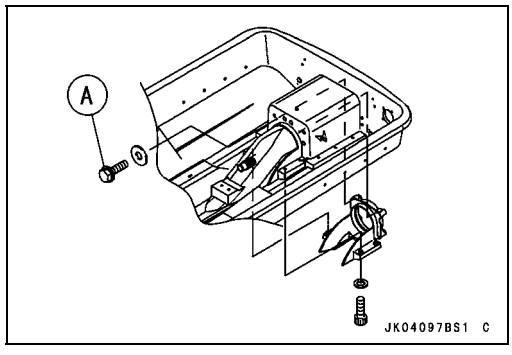


- Unscrew the pump mounting bolts [A].
- Slide the pump [B] to the rear to disengage the drive shaft, and remove it from the hull.

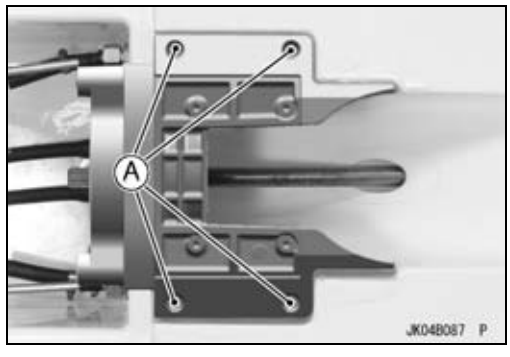


- To remove the pump bracket, perform the following procedures.

○Take out the pump bracket mounting bolts [A] and washer in the hull.

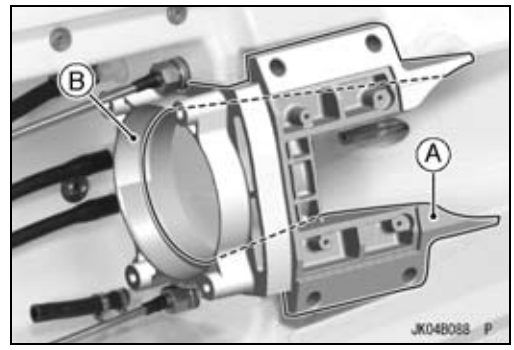


○Take out the pump bracket mounting bolts [A].



Pump and Impeller

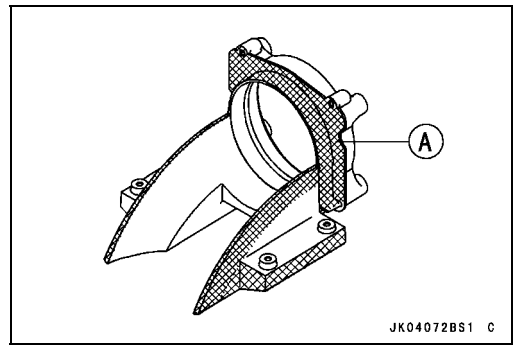
○Cut the sealant at the indicated area [A] in the figure and remove the pump bracket [B].



Pump Installation

- Strip off all the old sealant around the pump intake.
- Liberally coat the outside edge of the pump bracket with silicon sealant [A] to form a seal between the bracket and the hull.

Sealant - Kawasaki Bond (Silicone Sealant): 56019-120



- Install the pump bracket [A] to the hull.

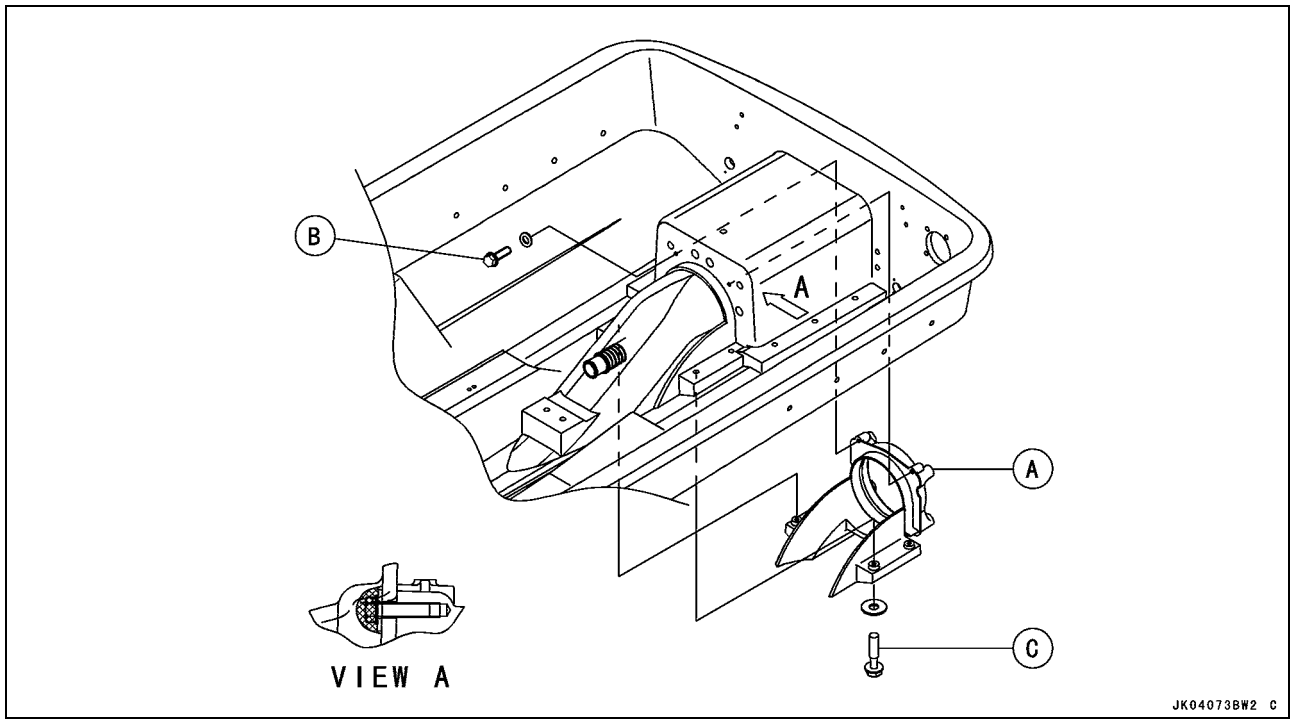
○Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the pump bracket mounting bolts (2) and torque them.

Torque - Pump Bracket Mounting Bolts (2) [B]: 19 N·m (1.9 kgf·m, 14 ft·lb)

○Apply a non-permanent locking agent to the pump bracket mounting bolts (4) and torque them.

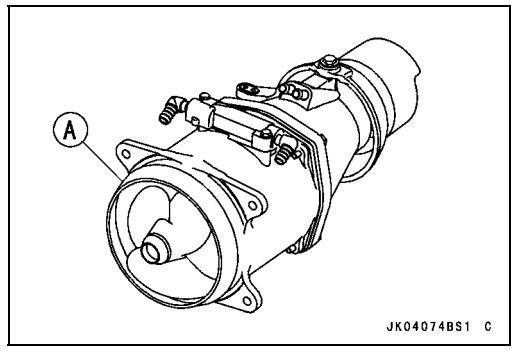
Torque - Pump Bracket Mounting Bolts (4) [C]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

○As for the pump bracket mounting bolts (2) in the hull, the bolt heads should be wrapped in silicone sealant.



Pump and Impeller

● Be sure trim seal [A] is in place.

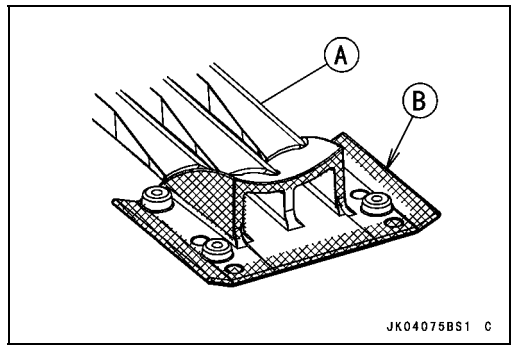


● Grease the splines on the drive shaft with molybdenum disulfide grease.
● Install the pump.
○Apply a non-permanent locking agent to the pump mounting bolts and torque them.

Torque - Pump Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

● Install the grate [A].
○Strip off all the old sealant around the grate.
○Apply silicone sealant at the indicated area [B] in the figure.
○Apply a non-permanent locking agent to the grate mounting bolts and torque them.

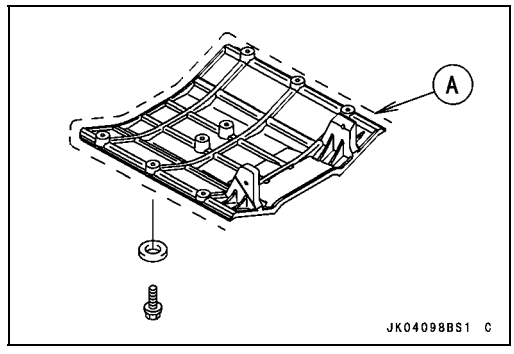
Torque - Grate Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



● Install the pump cover.
○Strip off all the old sealant around the pump cover.
○Apply a non-prmanent locking agent to the pump cover mounting bolts and torque them.

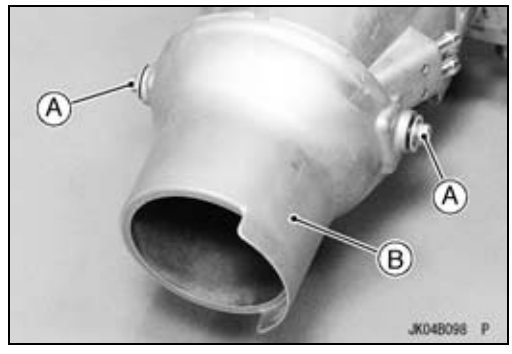
Torque - Pump Cover Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

○Liberally coat the outside edge of the pump cover with silicone sealant [A] to form a seal between the hull and the pump cover.



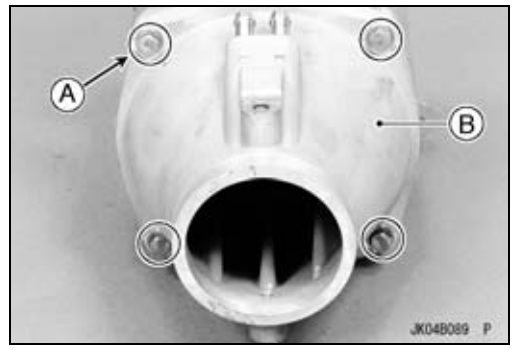
Pump Disassembly

● Unscrew the steering nozzle pivot bolts [A], and remove the steering nozzle [B].

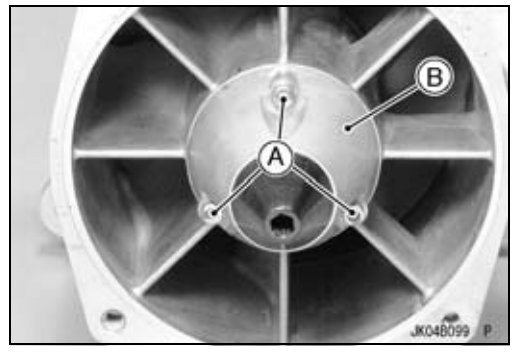


Pump and Impeller

- Unscrew the pump outlet mounting bolts [A], and remove the pump outlet [B].

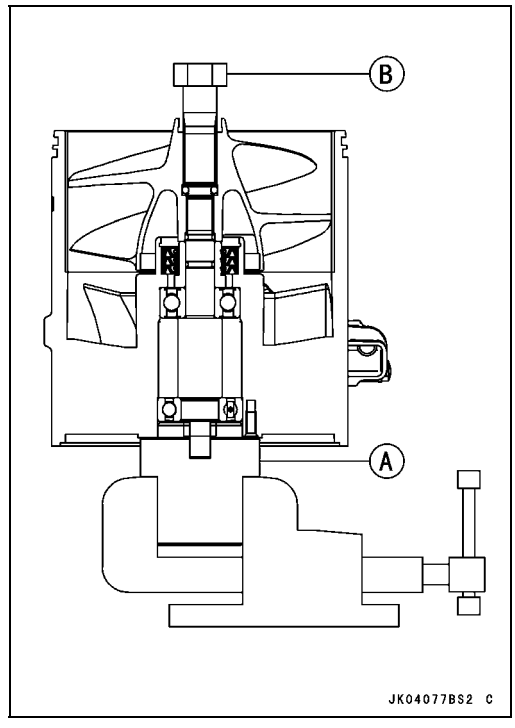


- Unscrew the pump cap bolts [A], and remove the pump cap [B].

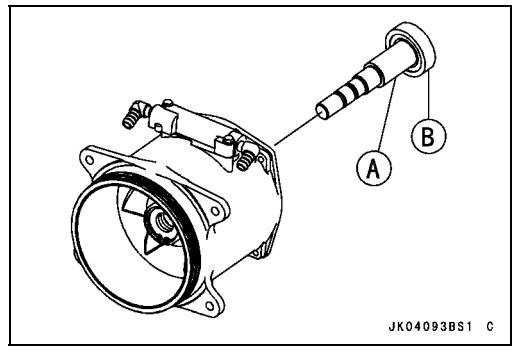


- Pull out the impeller seal on the impeller.
- Hold the shaft in the impeller holder, taking care not to damage it. Remove the impeller from the pump shaft and then pull out the pump shaft.

Special Tools - Impeller Holder: 57001-1695 [A]
Impeller Wrench: 57001-1228 [B]

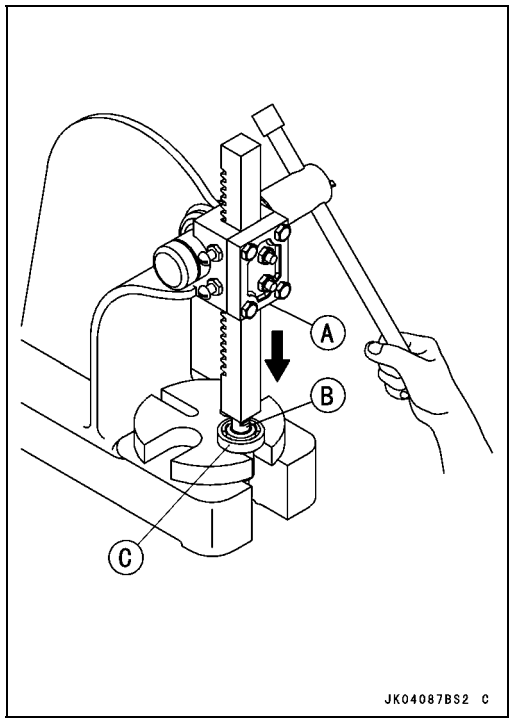


- Pull the pump shaft [A] with the bearing [B] out of the pump case.

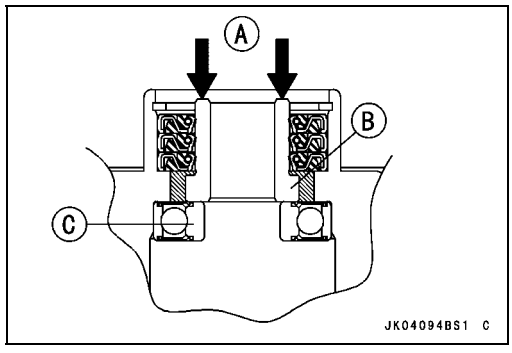


Pump and Impeller

- Remove the bearing [C] from the pump shaft [B] with a press [A].

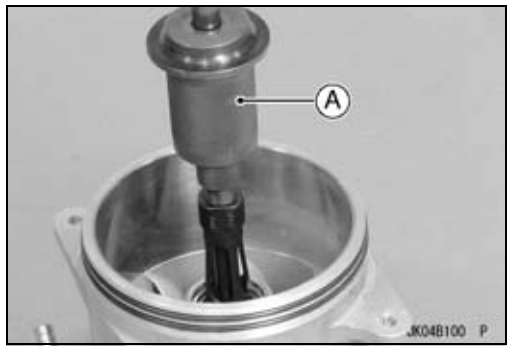


- Press [A] the bussing [B] and the ball bearing [C]. They come out of the pump case.



- Remove the circlip.
- Remove the grease seals.

Special Tool - Oil Seal & Bearing Remover: 57001-1058 [A]



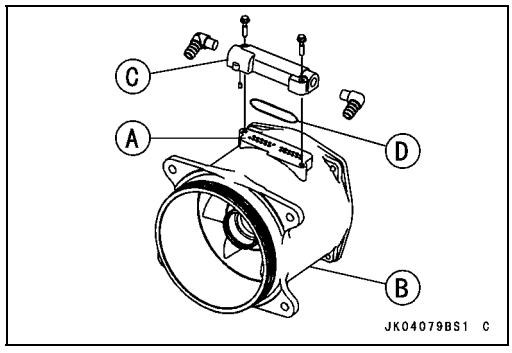
Pump Assembly

- Before installing the pump bearing, blow any dirt or foreign particles out of the pump case with compressed air.
- Before installing the pump bearing, remove the filter cover [C], and check the filter inside or outside [A] on the pump case [B] if the foreign particles do not cling to the filter.

○Apply high grade water resistant grease to the O-ring [D].

○Apply a non-permanent locking agent to the filter cover mounting bolts and torque them.

Torque - Filter Cover Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

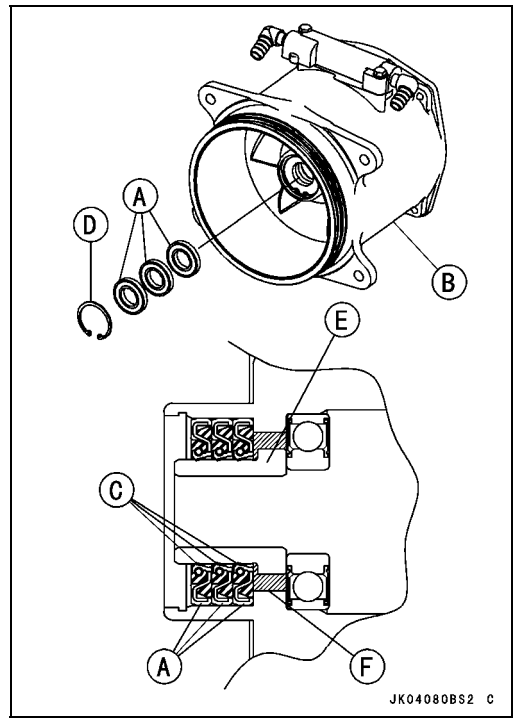


Pump and Impeller

● Replace the grease seals with new ones, if necessary, and install them.

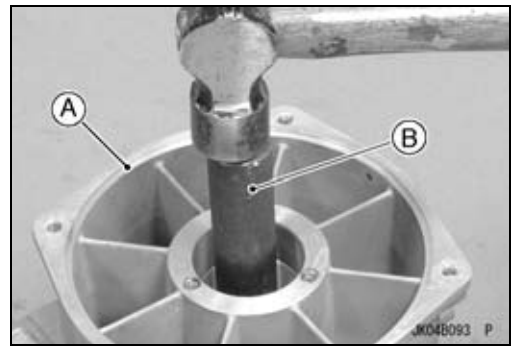
Special Tool - Bearing Driver Set: 57001-1129

○Press each seal [A] into the pump case [B] so that the side with the spring faces outward.
○Fill the gap between the grease seals [A] with high grade water resistance grease and apply it each grease seal lip [C].
● Install the circlip [D].
● Install the bushing [E] into the pump case.
○Fill with high grade water resistance grease (4g) [F].

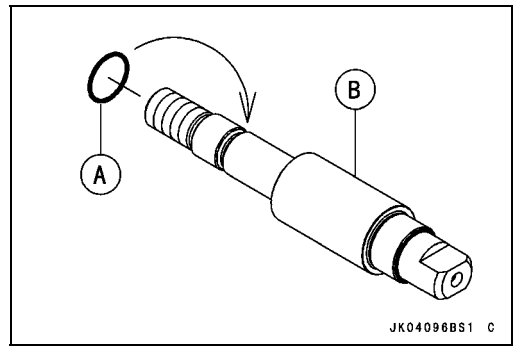


● Install a new bearing into the pump case [A] as far as it will go.

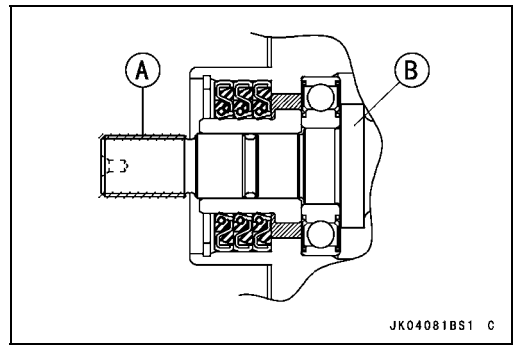
Special Tool - Bearing Driver Set: 57001-1129 [B]



● Visually inspect the pump shaft O-rings [A], and replace if necessary.
● Install the O-ring over the pump shaft [B].
○Grease the O-ring with high grade water resistance grease.
● Press the pump shaft into the bearing as far as it will go.



● Apply molybdenum disulfide grease [A] to the thread of the pump shaft
● Push the pump shaft [B] into the pump case.



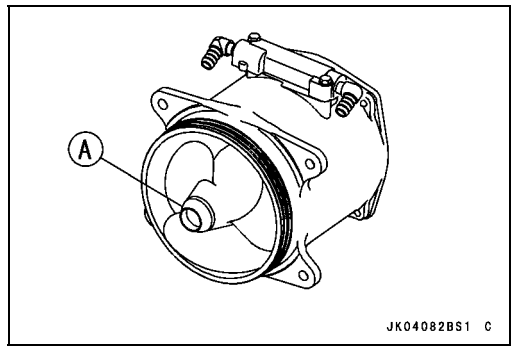
Pump and Impeller

● Screw on the impeller and torque.

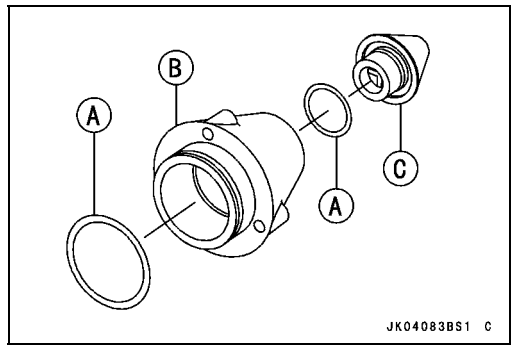
Special Tools - Impeller Holder: 57001-1695
Impeller Wrench: 57001-1228

Torque - Impeller: 98 N·m (10 kgf·m, 72 ft·lb)

● Visually inspect impeller seal [A], and replace it if necessary.
● Install the seal on the impeller.



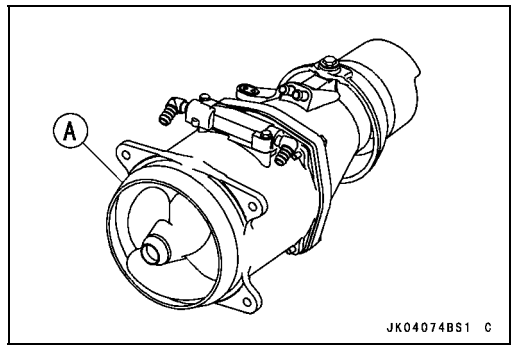
● Be sure the O-rings [A] are in place on the pump cap [B] and plug [C].
○Apply high grade water resistance grease to the O-rings.



● Install the following.
Pump Cap
Pump Cap Plug
Spacer
Pump Outlet
Steering Nozzle
○Apply a non-permanent locking agent to the thread of the following.
Pump Cap Bolts
Pump Outlet Mounting Bolts
Steering Nozzle Pivot Bolts

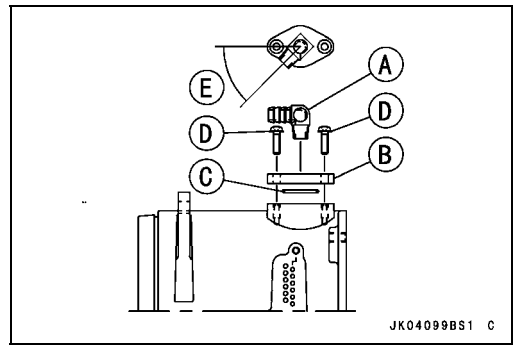
Torque - Pump Cap Bolts: 3.9 N·m (0.40 kgf·m, 35 in·lb)
Pump Outlet Mounting Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)
Steering Nozzle Pivot Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)

● Be sure the pump seal [A] is in place on the pump case.



Pump and Impeller

● When installing the water hose joint [A] for cooling intercooler and the cover [B], install them as follows.
○Apply high grade water resistance grease to the O-ring [C].
○Apply a non premanent locking agent to the bolts [D].
○Install the water hose joint as shown.
45 °[E]



Impeller Inspection

● Refer to Impeller Inspection in the Periodic Maintenance chapter.

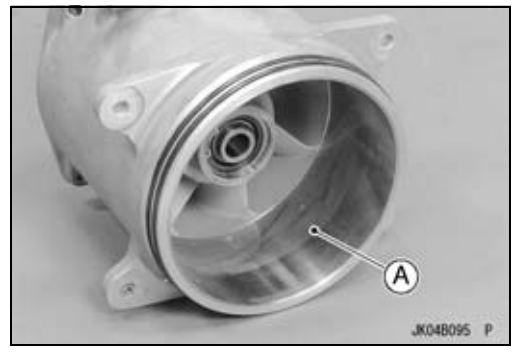
Impeller Outside Diameter Measurement

● Measure the impeller outside diameter.
★If the impeller is worn smaller than the service limit, replace it.

Impeller Outside Diameter
Standard: 154.5 ~ 154.7 mm (6.0827 ~ 6.0905 in.)
Service Limit: 153.5 mm (6.0433 in.)

Pump Inspection

● Examine the pump case [A].
★If there are deep scratches inside the pump case, replace it.



○Measure the inside diameter of the pump case.
★If the pump case is worn beyond the service limit, replace it.

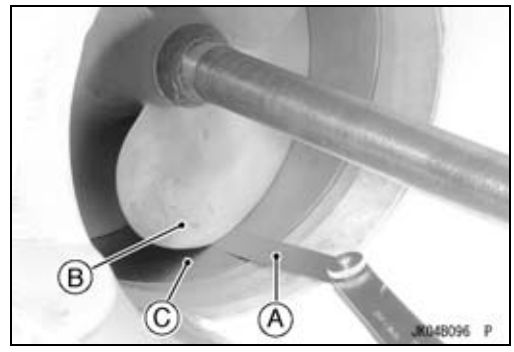
Pump Case Inside Diameter
Standard: 155.0 ~ 155.1 mm (6.1024 ~ 6.1063 n.)
Service Limit: 156.1 mm (6.1457 in.)

Impeller Clearance

● Impeller clearance is critical to proper performance. If the pump case and impeller are not visibly damaged, poor performance may be caused by too much impeller clearance.
● To check impeller clearance, remove the grate and insert a feeler gauge [A] between the tip of the impeller blade [B] and the pump case [C].

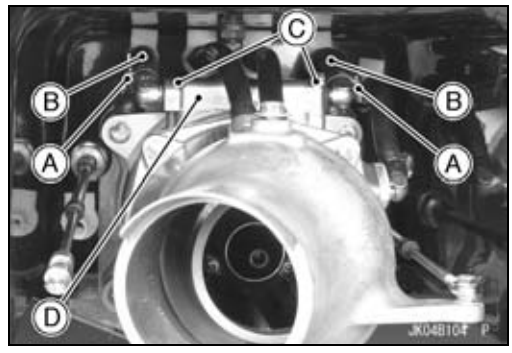
Impeller Clearance
Standard: 0.15 ~ 0.3 mm (0.0059 ~ 0.0118 in.)
Service Limit: 0.6 mm (0.0236 in.)

★If impeller clearance is incorrect, determine if it is due to wear or damage (see Pump and Impeller Inspection).



Pump and Impeller

Water Filter Cover Removal/Installation



- Loosen the clamps [A] and pull off the hoses [B].
- Remove the filter cover mounting bolts [C].
- Take out the filter cover [D].
- Replace the gasket with a new one.
- Installation is the reverse order of removal.
- Apply a non-permanent locking agent to the filter cover mounting bolts and torque them.

Torque - Filter Cover Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Steering

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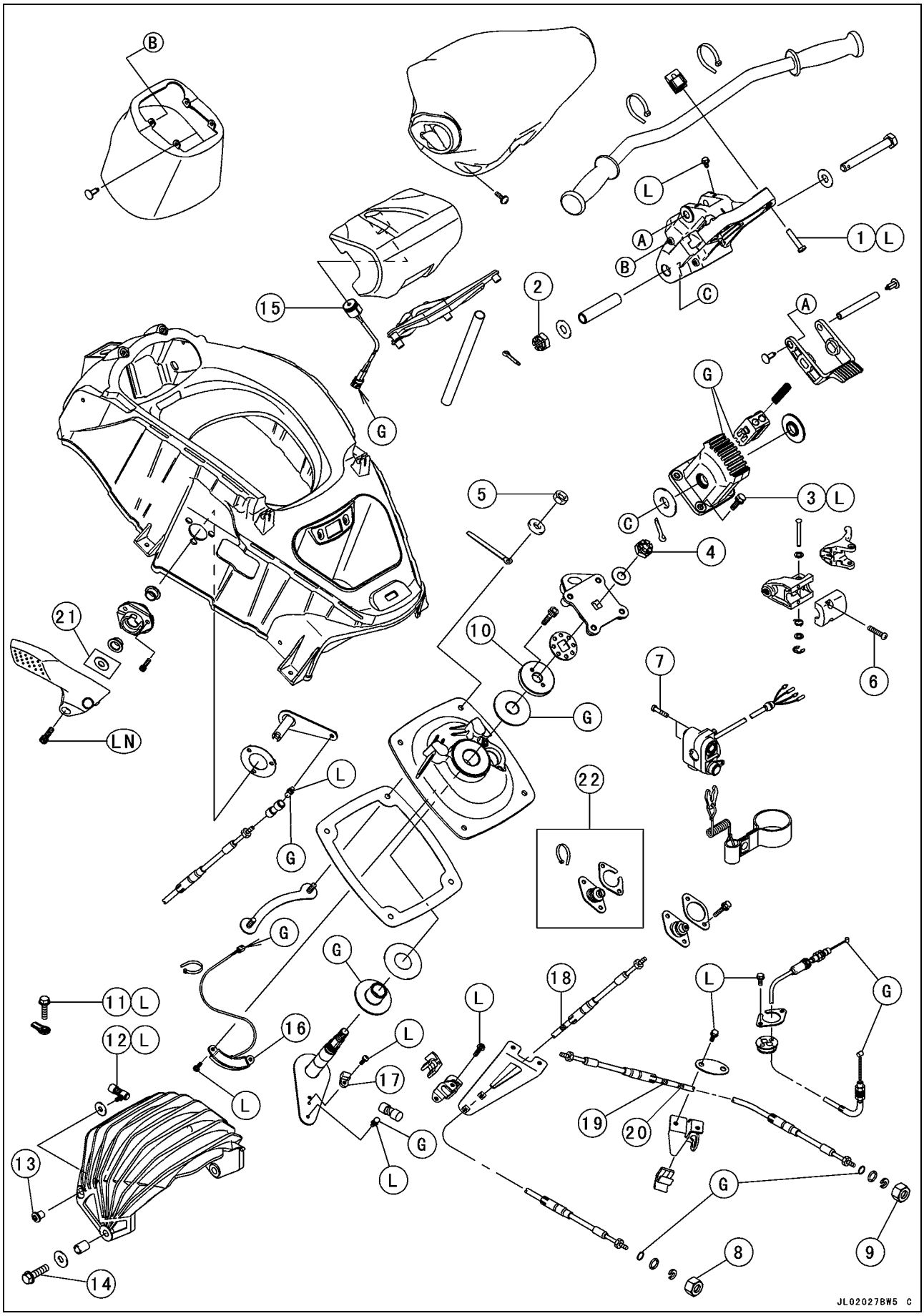
Exploded View



Exploded View

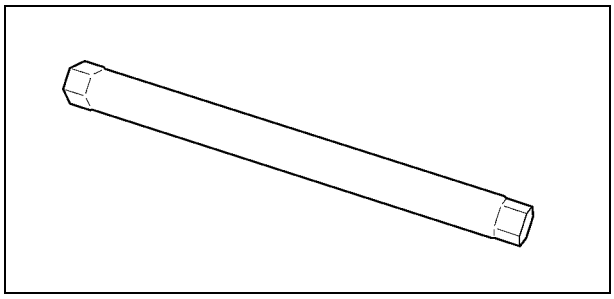
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar Clamp Bolts	16	1.6	12	L
2	Adjustable Steering Holder Nut	20	2.0	14.5	
3	Steering Neck Mounting Bolts	16	1.6	12	L
4	Steering Shaft Locknut	49 ~ 59	5.0 ~ 6.0	36 ~ 43	
5	Steering Holder Mounting Nuts	20	2.0	14.5	L
6	Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
7	Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
8	Shift Cable Nut	39	4.0	29	
9	Steering Cable Nut	39	4.0	29	
10	Steering Shaft Nut	2.9	0.30	26 in·lb	see text
11	Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
12	Ball Joint	9.8	1.0	87 in·lb	L
13	Shift Cable End Nut	9.8	1.0	87 in·lb	
14	Reverse Bucket Pivot Bolts	19	1.9	14	L

15. Buzzer
16. Steering Position Sensor
17. Magnet
18. Red Mark
19. White Mark
20. Red Mark
21. JT1500B7F (US-KAW33009B707 ~), JT1500B8F Models
22. JT1500B7F Model

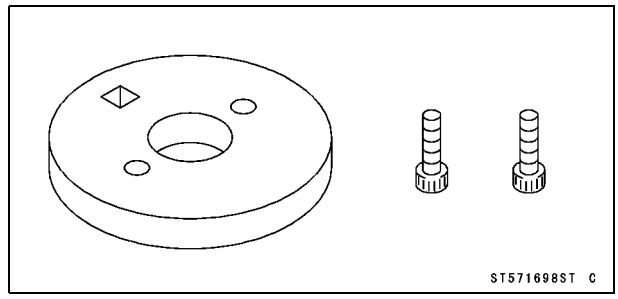
G: Apply grease.
L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).

Special Tools

Box Wrench (27 mm):
57001-1451



Nut Tightening Plate:
57001-1698

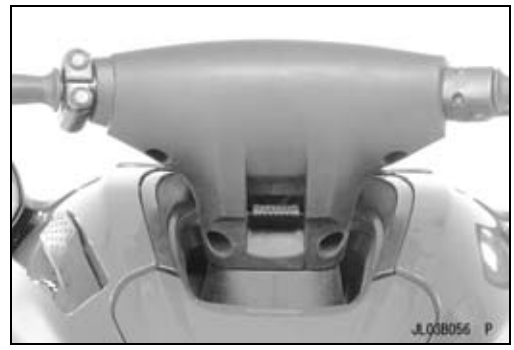


Steering Cable

Steering Cable Adjustment

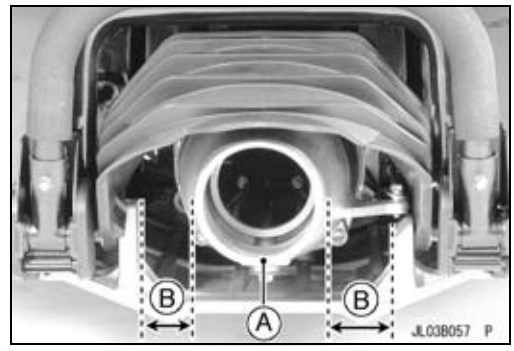
● Check the steering cable adjustment.

○Center the handlebar in the straight-ahead position.



● Check that the steering nozzle [A] is centered in the pump cavity.

○The same distance [B].



● If necessary, adjust the steering cable.

○Loosen the locknut [A] on the end of the steering cable located to the right of the steering nozzle.

○Take out the cable joint bolt [B] and disconnect the cable joint [C] from the steering nozzle.

○Center the handlebar in a straight ahead steering position.

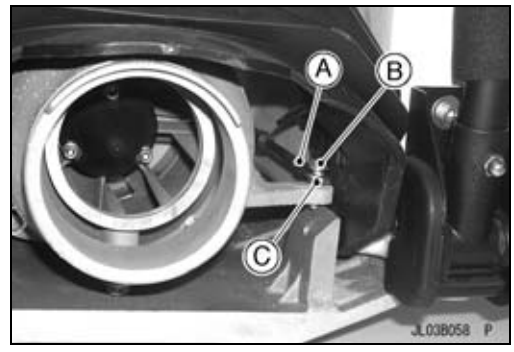
○Turn the joint on the cable to adjust the steering. The steering cable rod end must be inserted to the joint a minimum of 5 mm (0.2 in.).

○Temporarily tighten the cable joint bolt, and connect the joint with the nozzle and check cable adjustment again.

○When adjustment is correct, unscrew the cable joint bolt and apply a non-permanent locking agent to it. And tighten the cable joint bolt and the steering cable locknut securely.

Torque - Cable Joint Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

○As an additional check, turn the handlebar all the way to the left and right, and measure the distance between the nozzle and the edge of the pump cavity. It should be equal at both extremes.



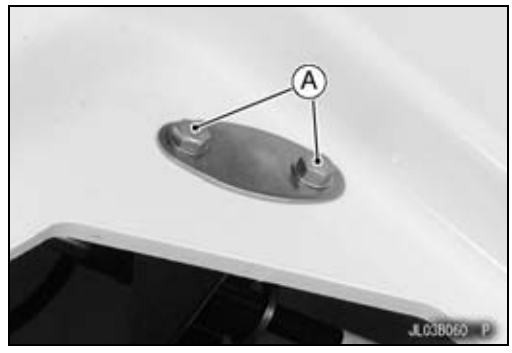
Steering Cable Removal

● Remove the steering cover (see Steering Removal).

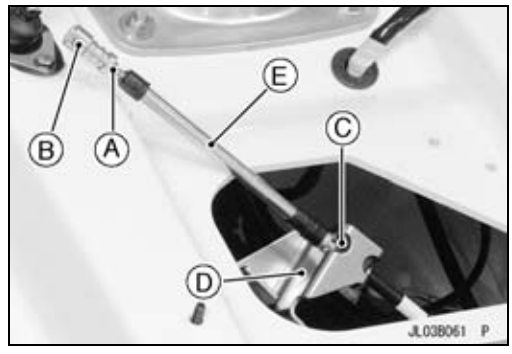
● Pull out the center access cover [A].

Steering Cable

- Slide back the outer sleeve of the ball joint and take off the ball joint.
- Remove the cable bracket mounting bolts [A].



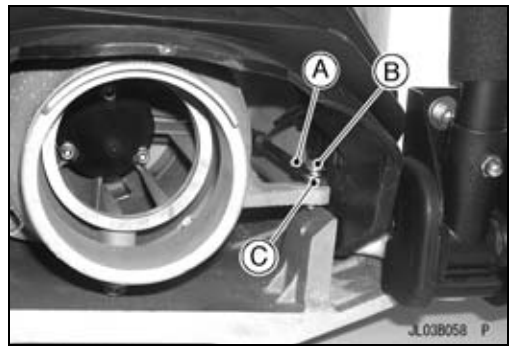
- Loosen the locknut [A] at the front end of the steering cable and take off the ball joint [B], and remove the locknut from the cable front end.
- Pull the holder [C] off the cable bracket [D].
- Slide the steering cable [E] off the cable bracket.



- Turn the watercraft on its left side and remove the pump cover (see Pump Removal in Pump/Impeller chapter).

CAUTION

Never lay the watercraft on the right side. Water in the exhaust system may drain back into the engine, causing serious damage.

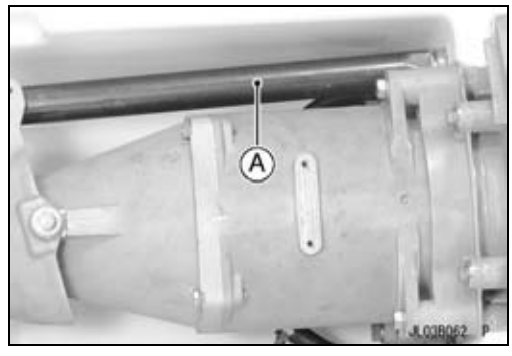


- Loosen the locknut [A] at the rear end of the steering cable, and remove the joint bolt [B].
- Remove the joint [C] and locknut from the cable end.

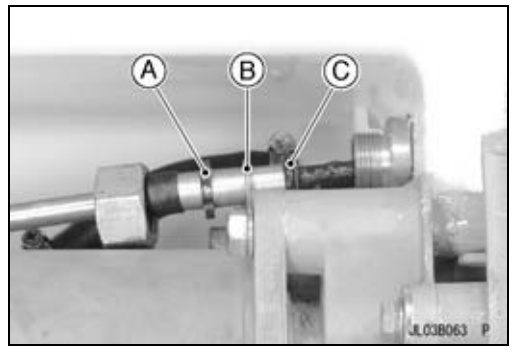
- Unscrew the large nut (steering cable nut) in the hull with a wrench.

○Special tool, box wrench [A] is useful to remove the large nut (steering cable nut).

Special Tool - Box Wrench: 57001-1451

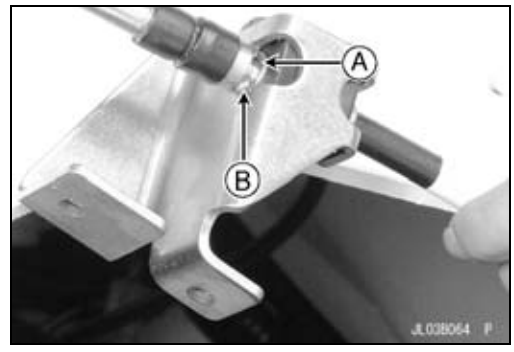


- Slide off the snap ring [A], washer [B] and O-ring [C].
- Pull out the steering cable toward the rear.



Steering Cable

Steering Cable Installation



- Slide a short piece of rubber or plastic tubing over the front cable end to guide the cable through the hull.
- Lubricate the outside of the new cable to ease cable installation.
- Torque:

Torque - Steering Cable Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)

- Align the groove [A] on the steering cable with the opening portion [B] on the cable bracket as shown.
- Install the steering cable both end to the joints. The steering cable rod ends must be inserted to the joints a minimum of 5 mm (0.2 in.).
- Apply a non-permanent locking agent to the cable joint bolt and the steering cable bracket mounting bolts.

Torque - Cable Joint Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Apply a water resistant grease to the joint ball.
- Adjust the steering cable (see Steering Cable Adjustment).

Steering Cable Inspection

- Refer to Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter (see Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter).

Steering Cable Lubrication

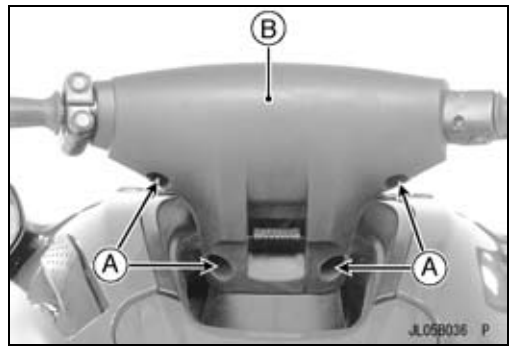
NOTE

○*The steering cable is sealed at each end and do not require lubrication. If the seal is damaged, the cable must be replaced.*

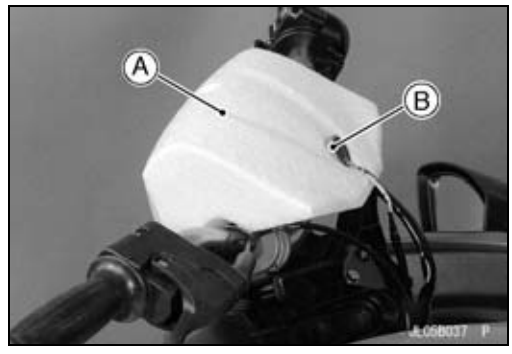
Handlebar

Handlebar Removal

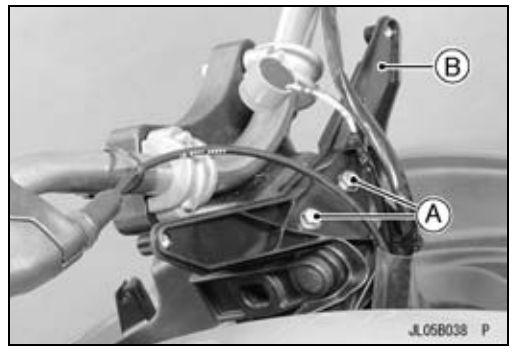
- Unscrew the mounting screws [A] and remove the handlebar pad [B].



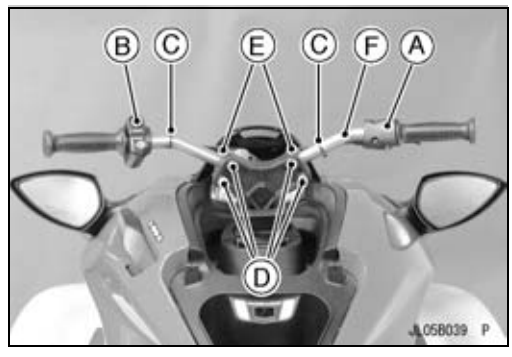
- Remove the inner pad [A] and the buzzer [B].



- Unscrew the bolts [A] and remove the pad holder [B].



- Take out the throttle case clamp screws and remove the throttle case [A].
- Take out the switch case clamp screws and remove the switch case [B].
- Cut off the clamps [C] holding the switch leads and throttle cable.
- Unscrew the handlebar clamp bolts [D] and remove the handlebar clamps [E] and handlebar [F].



Handlebar Installation

- Install the pad holder.

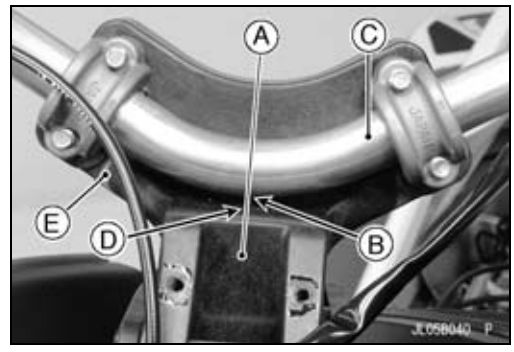
○Apply a non-permanent locking agent to the pad holder bolts.

- Install the handlebar on the holder of the steering neck.

○Apply a non-permanent locking agent to the handlebar clamp bolts.

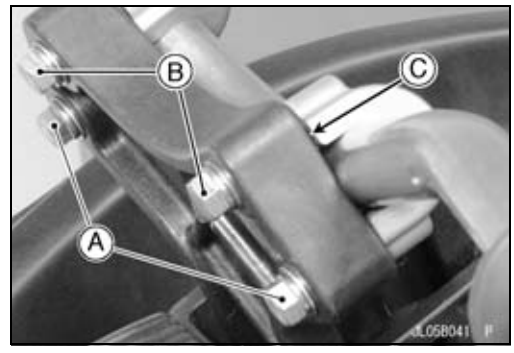
Handlebar

○Align [A] the hole [B] on the handlebar [C] with the mark [D] on the steering shaft holder [E].



○Tighten the lower clamp bolts [A] first, and then the upper clamp bolts [B] to the specified torque. There will be a gap [C] at the upper part of the clamp after tightening.

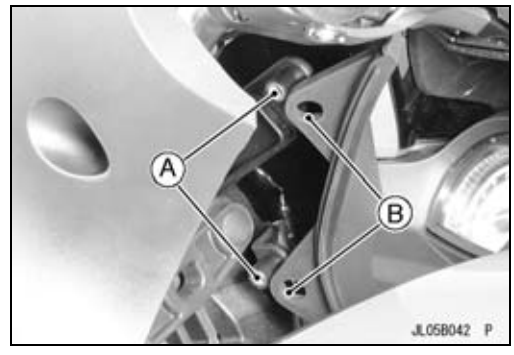
Torque - Handlebar Clamp Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)



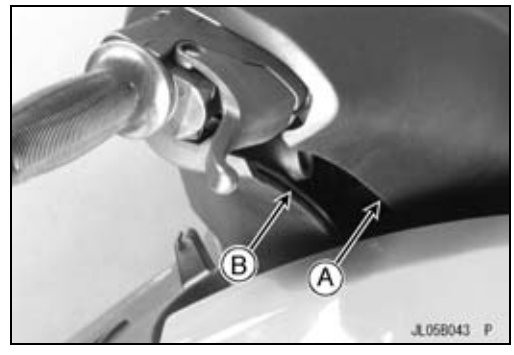
- Install the throttle case and switch case. Tighten the screws.

Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 35 in·lb)
Switch Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 35 in·lb)

- Route the cable, wire and hose correctly (see Cable, Wire, and Hose Routing section in the Appendix chapter).
- Install the bosses [A] on the pad holder to the holes [B] on the handlebar pad.



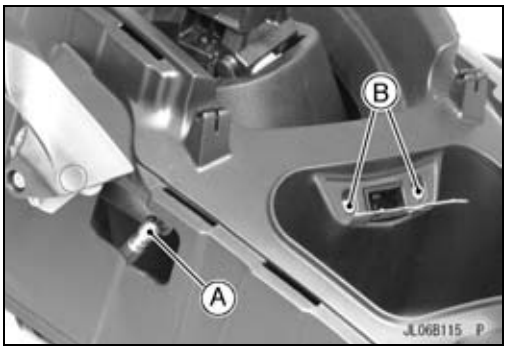
- Align the projection [A] on the pad with the groove [B] on the pad.



Steering

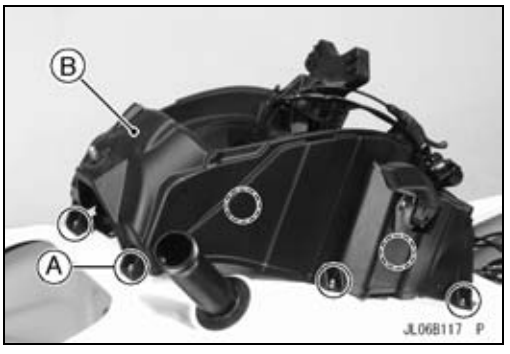
Steering Removal

- Remove the center storage compartment lid (see Right/Left Cover Removal in the Hull/Engine Hood chapter).
- Remove the right/left cover (see Right/Left Cover Removal in the Hull/Engine Hood chapter).
- Remove the handlebar and pad holder (see Handlebar Removal).
- Disconnect the shif cable ball joint [A] at the upper end.
- Unscrew the immobilizer switch mounting bolts [B] and washers.

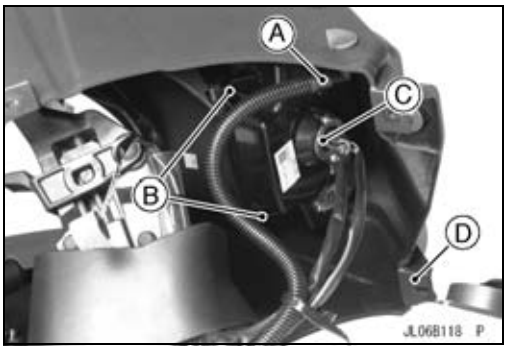


- Unscrew the meter mounting bolts [A].

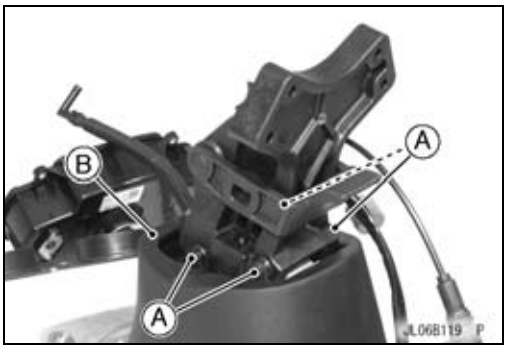
- Unscrew the steering cover mounting nuts [A] and washers and lift up the steering cover [B].



- Disconnect the fuel vent hose [A].
- Unscrew the meter mounting bolts [B] and washers and remove the meter unit [C] with the leads.
- Remove the steering cover [D].

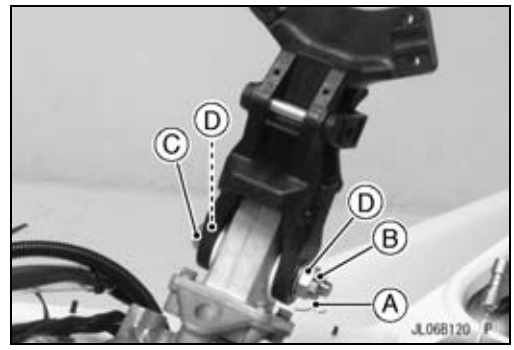


- Take out the rivets [A] and remove the steering pad [B].

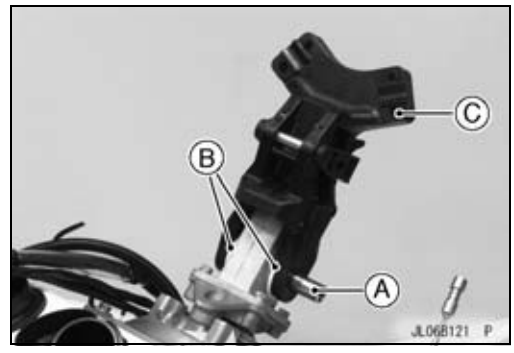


Steering

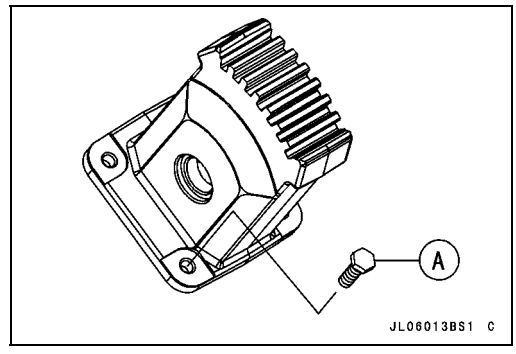
- Remove the cotter pin [A].
- Unscrew the nut [B] and bolt [C], and take off the washers [D].



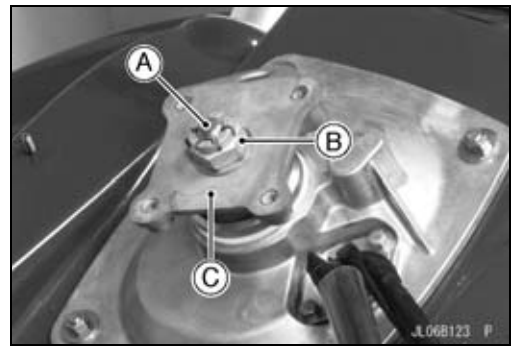
- Pull out the shaft [A], and remove the bushings [B] and adjustable steering holder [C].



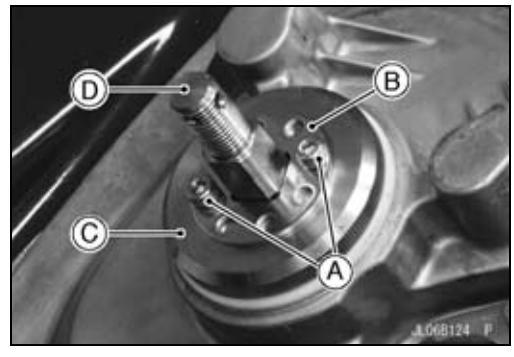
- Unscrew the steering neck mounting bolts [A] and remove the steering neck.



- Remove:
  Cotter Pin [A]
  Steering Shaft Locknut [B]
  Washer
  Holder [C]

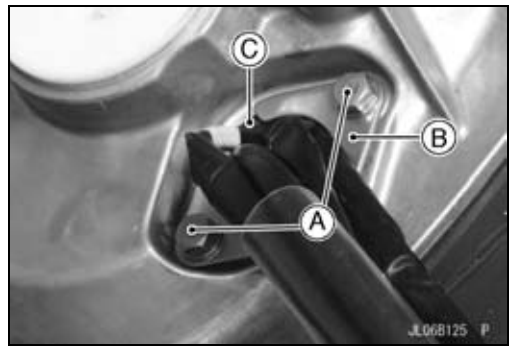


- Remove:
  Lock Plate Mounting Bolts [A]
  Lock Plate [B]
  Steering Shaft Nut [C]
  Steering Shaft [D]



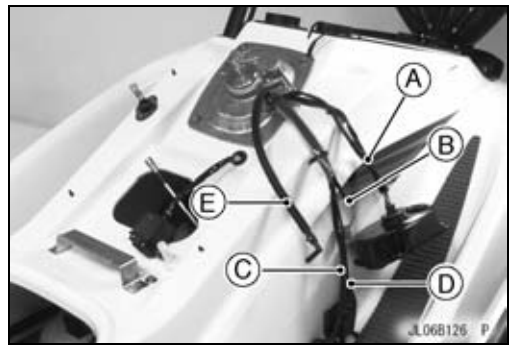
Steering

- Unscrew the grommet mounting plate bolts [A] and remove the grommet mounting plate [B].
- Pull up the grommet [C].

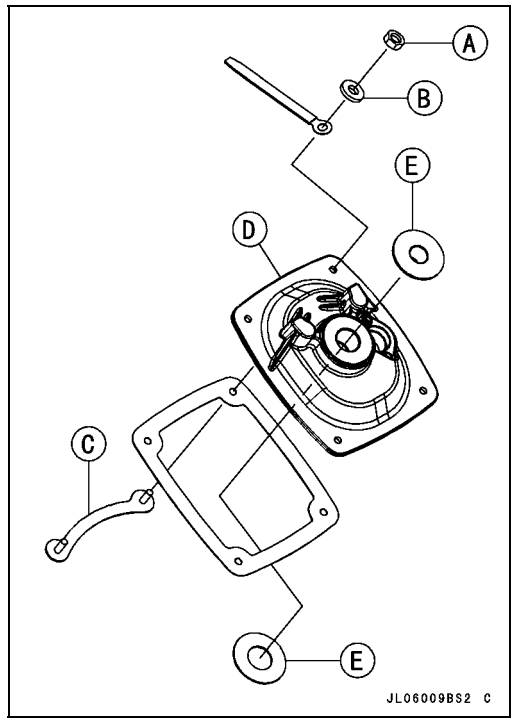


- Disconnect:
  Steering Position Sensor Lead Connector
  Buzzer Connector
  Multifunction Meter Lead Connectors
  Steering Cable Ball Joint at Upper End
  Switch Case Lead Connector
  Throttle Cable Upper End at Throttle Case

- Pull up:
  Multifunction Meter Leads [A]
  Buzzer Leads [B]
  Switch Case Leads [C]
- Pull down:
  Fuel Vent Hose [D]
  Throttle Cable [E]



- Unscrew the steering holder mounting nuts [A], washers [B] and bracket [C], and take off the steering holder [D].
- Remove the bushings [E].



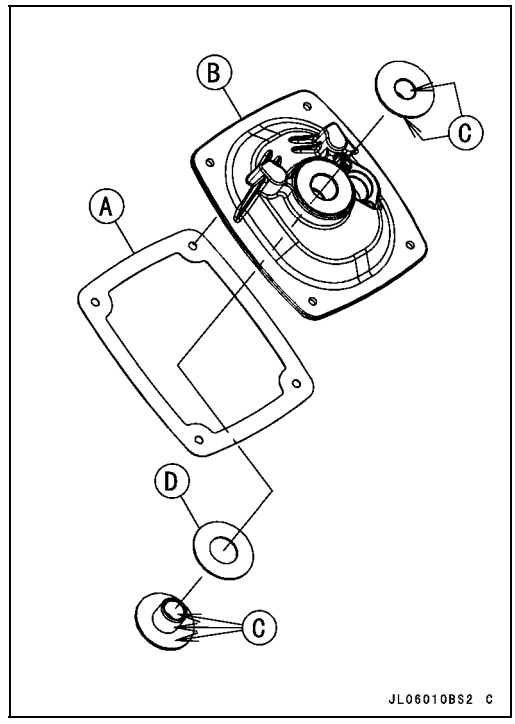
Steering

Steering Installation

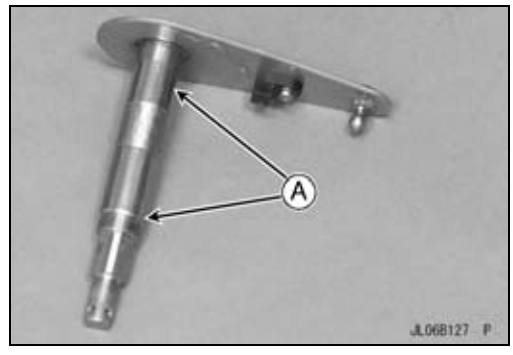
- Replace the gasket [A] on the steering holder [B] with a new one.
- Check the bushings for damage and wear before installing the steering holder.

★If the bushings are damaged or worn, replace them.

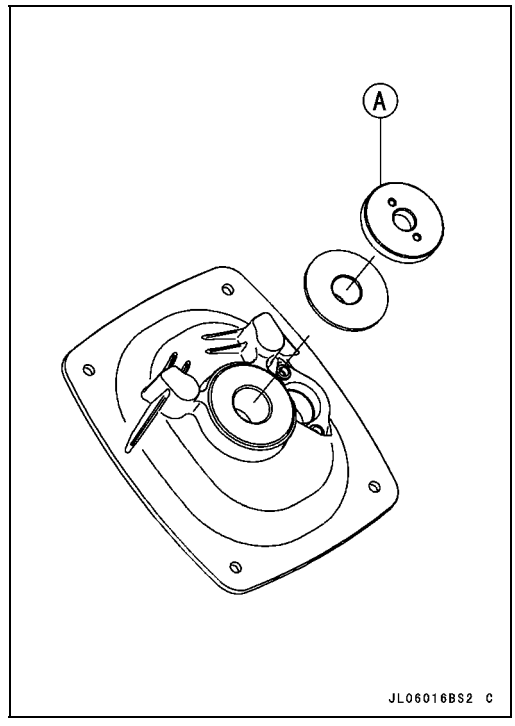
- Grease:
  Bushings [C]
- Put the washer [D] on the steering holder.



- Grease:
  Steering Shaft [A]



- Install the steering shaft.
- Tighten the steering shaft nut [A] by hand and then loose one time.



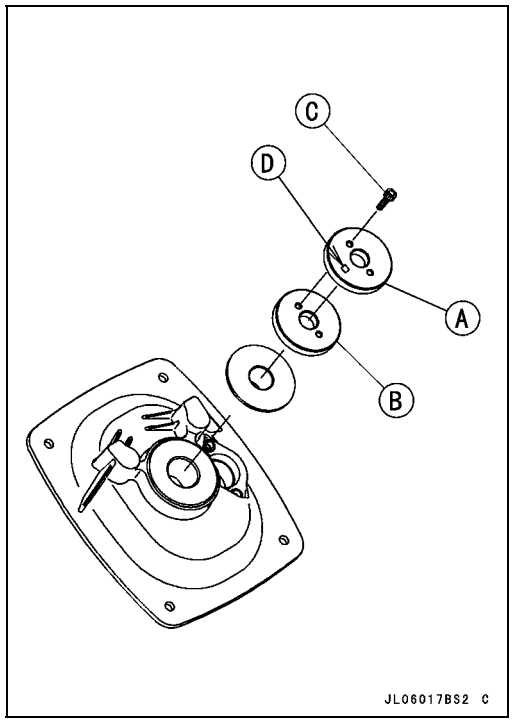
Steering

- Put the nut tightening plate [A] on the steering shaft nut [B].
- Fasten the plate with two bolts [C].

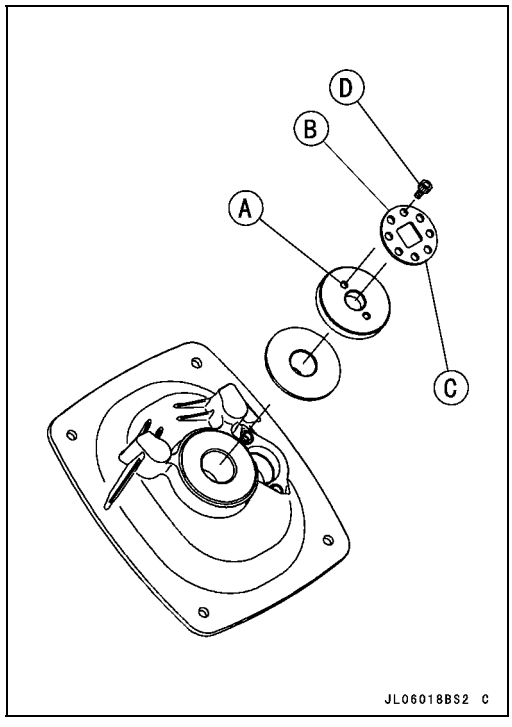
Special Tool - Nut Tightening Plate: 57001-1698

- Put the square portion [D] of the torque wrench on the square portion of the plate.
- Torque (2.6 N·m, 0.27 kgf·m, 23 in·lb) the plate with nut.

Torque - Steering Shaft Nut: 29 N·m (0.3 kgf·m, 173 in·lb)

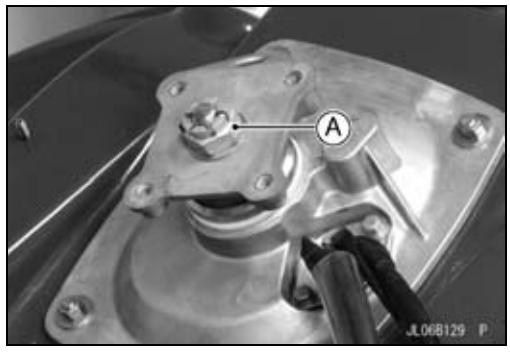


- Remove the bolts and nut tightening plate (special tool).
- Loosen the steering shaft nut so that threads [A] of steering shaft nut are aligned with the holes [B] of plate [C] within second chance.
- Tighten the bolts [D] and check steering shaft turns freely with no play.



- Torque the steering shaft locknut [A].

Torque - Steering Shaft Locknut: 49 ~ 59 N·m (5.0 ~ 6.0 kgf·m, 36 ~ 44 ft·lb)

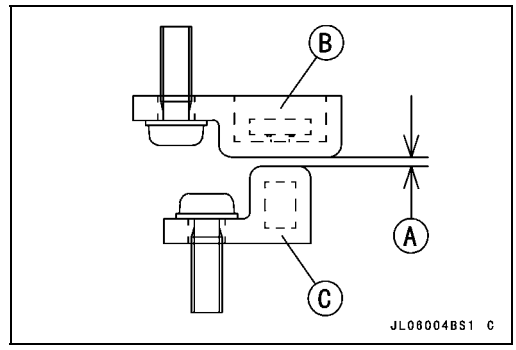


Steering

- Turning the steering shaft fully in left and right direction, check whether the steering position sensor comes in contact with the magnet.
- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance
Standard: 0.5 ~ 1.5 mm (0.02 ~ 0.06 in.)

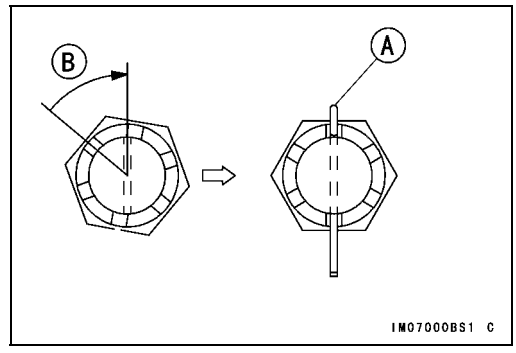
★If necessary, adjust the clearance by turning the steering shaft nut.



- Replace the cotter pin [A] with a new one.

NOTE

○*When inserting the cotter pin, if the slots in the locknut do not align with the cotter pin hole in the steering shaft, tighten the locknut clockwise [B] up to next alignment.*
○*It should be within 30 degree.*
○*Loosen once and tighten again when the slot goes past the nearest hole.*

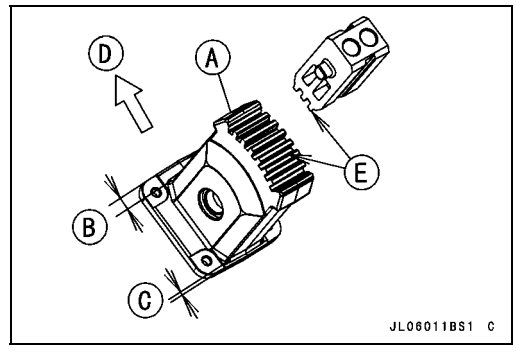


- Bend the cotter pin over the nut.
- Install the steering holder.

Torque - Steering Holder Mounting Nuts: 20 N·m (2.0 kgf·m, 15 ft·lb)

- Install the steering neck [A] so that its wide side [B] faces the front [D] as shown.
  Narrow Side [C]
- Grease [E] the upper part of the steering neck and the lower part of the adjustable rod.
- Apply a non-permanent locking agent to the steering neck mounting bolts.

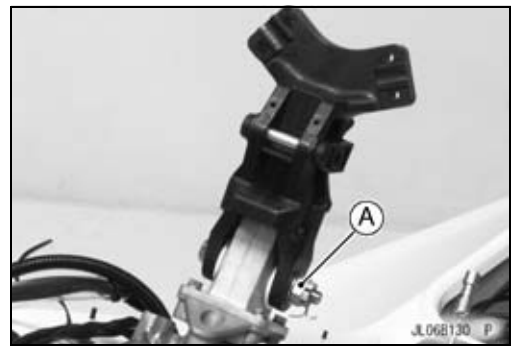
Torque - Steering Neck Mounting Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)



- Apply a non-permanent locking agent to the grommet mounting plate.

Torque - Adjustable Steering Holder Nut [A]: 16 N·m (1.6 kgf·m, 12 ft·lb)

- Apply a water resistant grease to the joint balls of the shift cable and shift link rod.
- Adjust the steering cable.



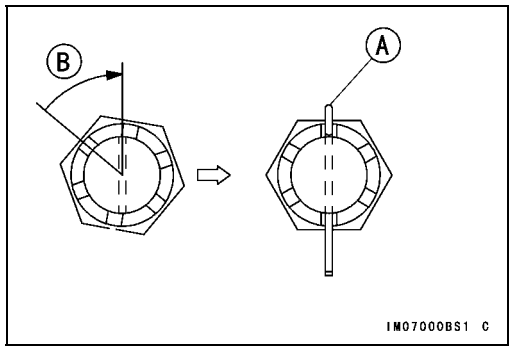
Steering

● Replace the cotter pin [A] with a new one.

NOTE

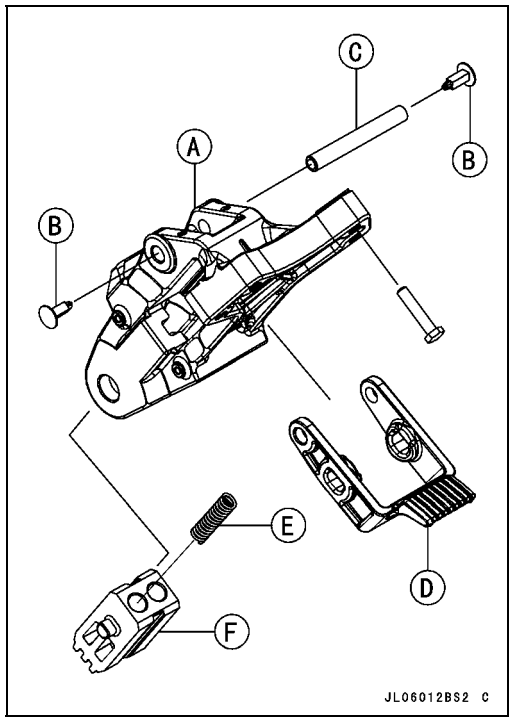
○*When inserting the cotter pin, if the slots in the locknut do not align with the cotter pin hole in the steering shaft, tighten the locknut clockwise [B] up to next alignment.*
○*It should be within 30 degree.*
○*Loosen once and tighten again when the slot goes past the nearest hole.*

● Bend the cotter pin over the nut.



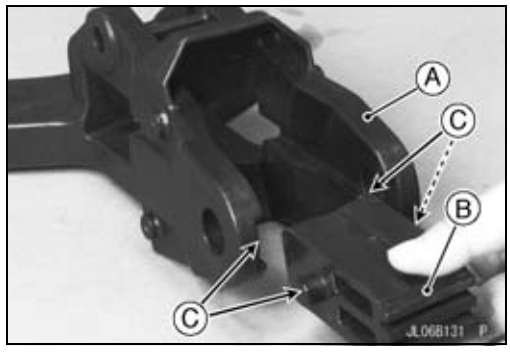
Adjustable Steering Holder Disassembly

● Remove the adjustable steering holder (see Steering Removal).
● Remove the following from the adjustable steering holder [A].
Rivets [B]
Shaft [C]
Tilt Lever [D]
Springs [E]
Rod [F]

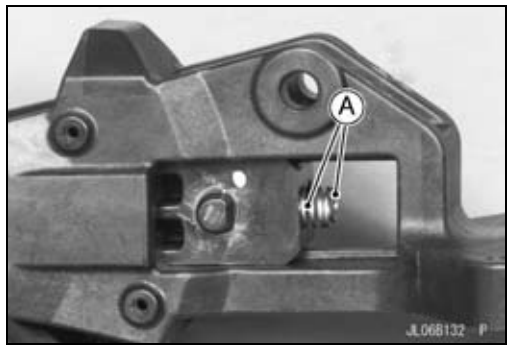


Adjustable Steering Holder Assembly

● Insert the rod [B] into the adjustable steering holder [A].
○Align [C] the projections on the rod with the grooves on the holder.

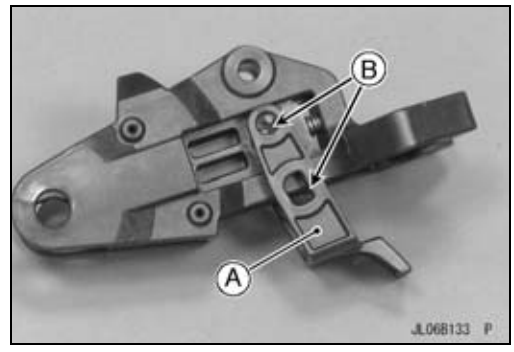


● Be sure that the springs [A] are in place



Steering

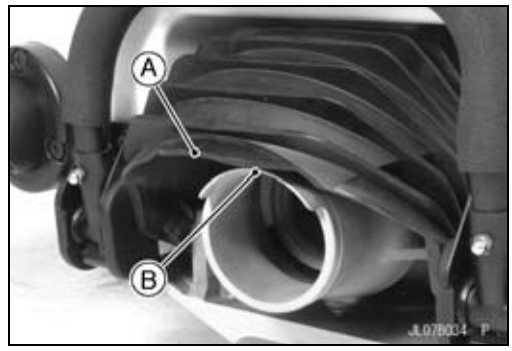
● Install the tilt lever [A] on the adjustable steering holder.
○Align [B] the projection on the rod with the hole on the tilt lever.

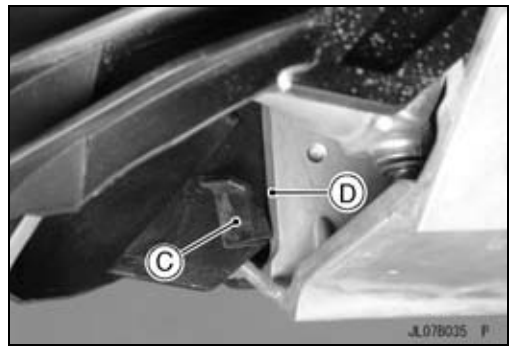


Reverse System

Shift Cable Adjustment

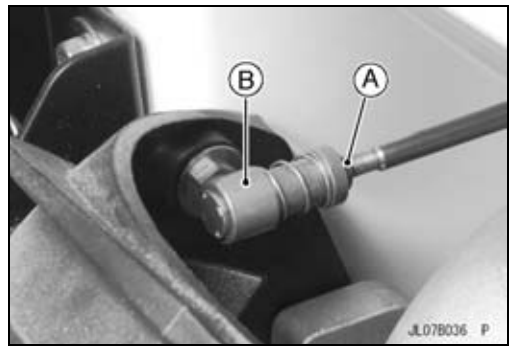
- Check the shift cable adjustment.
- When the shift lever is in the “F” position, the lower edge [A] of the bucket should be held above the top [B] of the steering nozzle with slight play so it doesn’t interfere with the water flow from the jet pump.
- When the shift lever is in the “R” position, the lower stopper [C] on the bucket should rest against the bottom [D] of the pump cover.





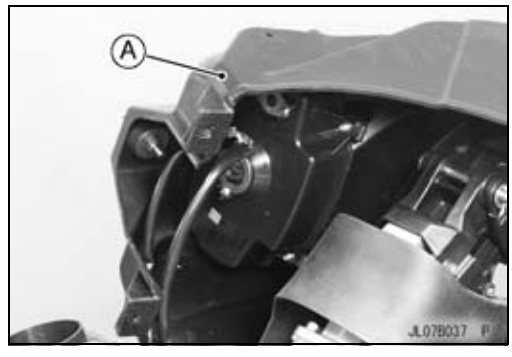
★If either position is incorrect, adjust the shift cable.

- Put the shift lever in the “R” position.
- Loosen the locknut [A] at the end of the shift cable.
- Slide back the outer sleeve and take the ball joint [B] off the ball.
- Turn the ball joint on the cable to adjust the shift cable.
- Connect the ball joint and check the cable adjustment again.
- When adjustment is correct, tighten the shift cable locknut.

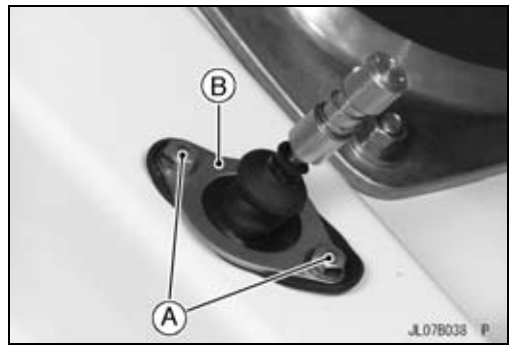


Shift Cable Removal

- Lift up the steering cover [A] (see Steering Removal).

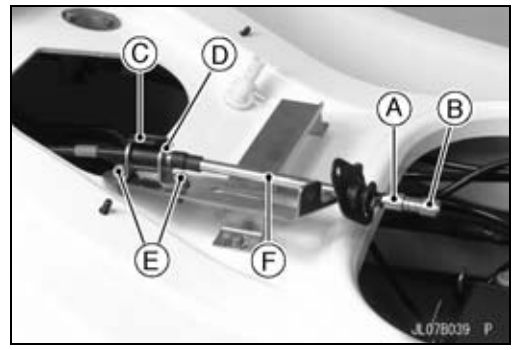


- Remove:
  Plate Bolts [A]
  Plate [B]



Reverse System

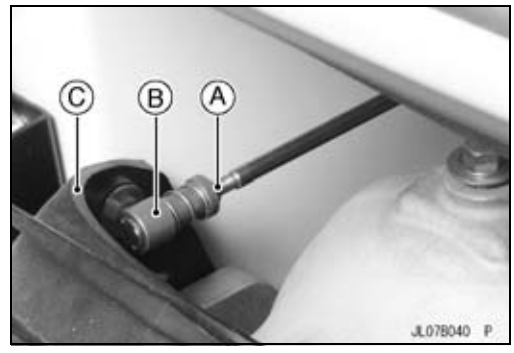
- Loosen the locknut [A] at the front end of the shift cable and take off the ball joint [B], and remove the locknut from the cable front end.
- Pull the holder [C] off the cable bracket [D].
- Remove the cable bracket mounting bolts [E].
- Slide the shift cable [F] off the cable bracket.



- Turn the water craft on its left side and remove the pump cover (see Pump Removal in the Pump/Impeller chapter).

CAUTION

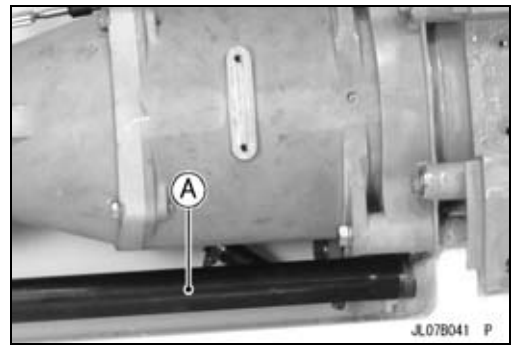
Never lay the watercraft on the right side. Water in the exhaust system may drain back into the engine, causing serious damage.



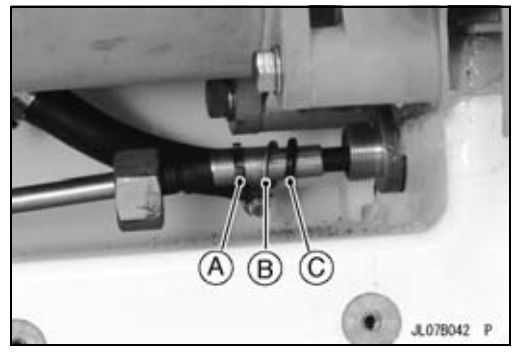
- Loosen the locknut [A] at the rear end of the shift cable, and remove the ball joint [B] from the reverse bucket [C],

- Disconnect the shift cable from the fitting at the middle of the hull.
  - Unscrew the large nut (shift cable nut) in the hull with a wrench.
  - Special tool, box wrench [A] is useful to remove the large nut (shift cable nut).

  Special Tool - Box Wrench: 57001-1451

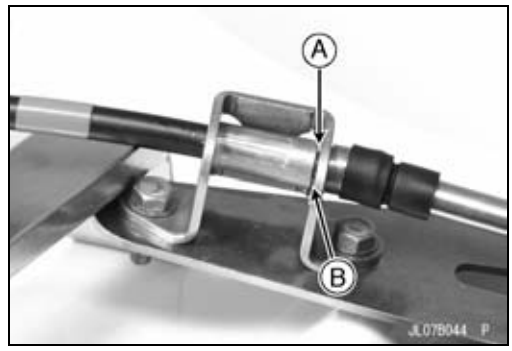


- Slide off the snap ring [A], washer [B] and O-ring [C].
- Pull out the shift cable toward the rear.



Reverse System

Shift Cable Installation



- Slide a short piece of rubber or plastic tubing over the front cable end to guide the cable through the hull.
- Lubricate the outside of the new cable to ease cable installation.
- Torque the shift cable nut.

Torque - Shift Cable Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)

- Align the groove [A] on the steering cable with the opening portion [B] on the cable bracket as shown.
- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the cable bracket mounting bolt.
- Apply a water resistant grease to the joint ball at each end of shift cable.
- Adjust the shift cable (see Shift Cable Adjustment).

Shift Cable Inspection

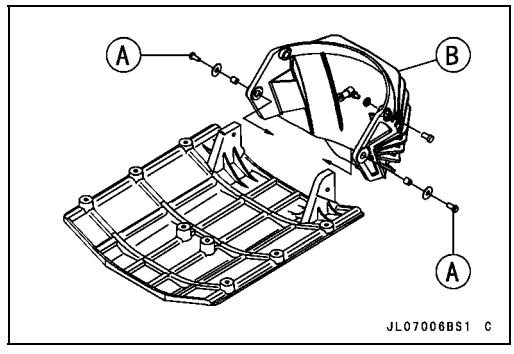
- Refer to Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter (see Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter).

Shift Cable Lubrication

NOTE

○*The shift cable is sealed at each end and do not require lubrication. If the seal is damaged, the cable must be replaced.*

Reverse Bucket Removal/Installation



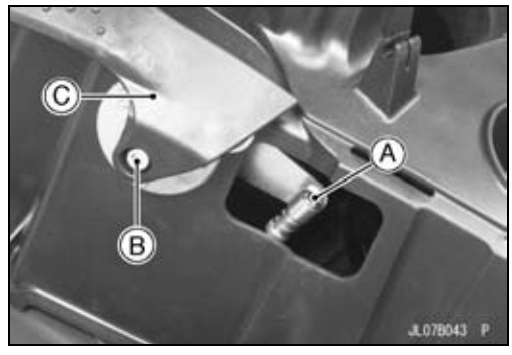
- Disconnect the ball joint at rear end of the shift cable.
- Remove the pump cover (see Pump Removal in the Pump/Impeller chapter).
- Unscrew the pivot bolts [A] and remove the reverse bucket [B].
- Installation is the reverse of removal. Note the following.

○Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the reverse bucket pivot bolts, and torque them.

Torque - Reverse Bucket Pivot Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)

○After installation, check the shift cable adjustment.

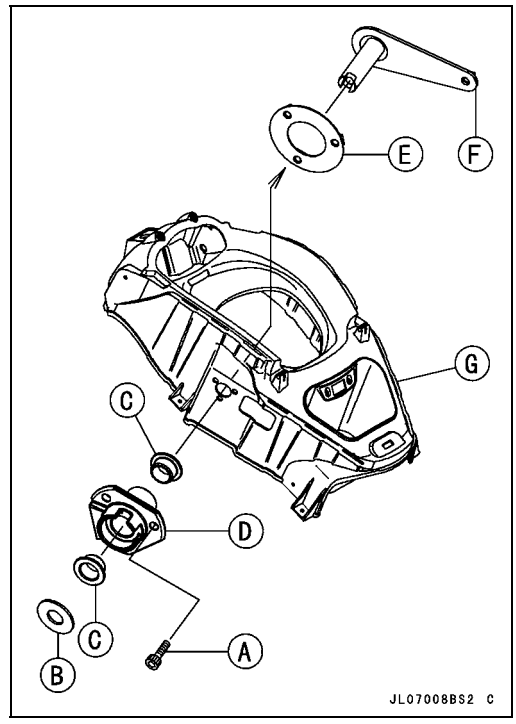
Shift Lever Shaft Removal/Installation



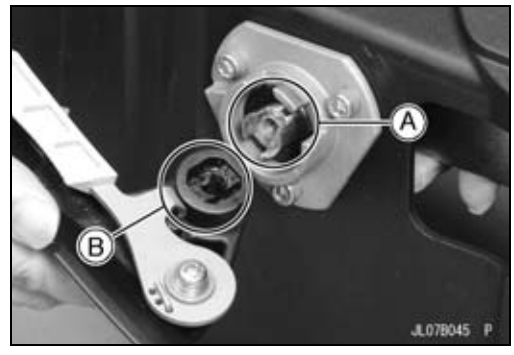
- Remove the right/left cover (see Right/Left Cover Removal in the Hull/Engine Hood chapter).
- Disconnect the shift cable ball joint [A] at upper end.
- Unscrew the shift lever bolt [B] and remove the shift lever [C].

Reverse System

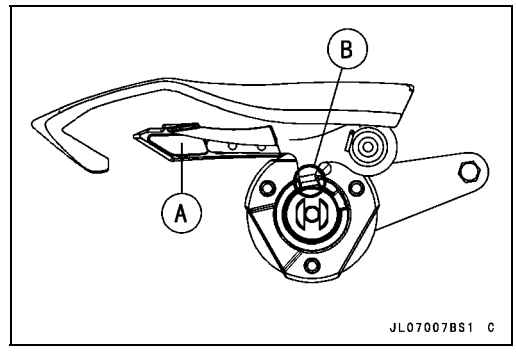
● Unscrew the steering cover bolts (see Steering Removal).
● Remove:
Shift Lever Holder Bolts [A]
Washer (JT1500B7F: US-KAW33009B707 ~, JT1500B8F Models) [B]
Collars [C]
Shift Lever Holder [D]
Shift Lever Bracket [E]
Shift Lever Shaft [F]
○Lift up the steering cover [G] (see Steering Removal).



● Assemble the shift lever holder, noting the following.
○Apply a non permanent locking agent (Hight Strength: Loctite 271 equivalent) to the shift lever holder bolts.
○Align the slot [A] on the shift lever shaft with the projection [B] on the shift lever.
○Before connecting the shift cable, apply a water resistant grease to its joint ball.



● Inspect the reverse lever [A] is properly locked [B] to forward.
★Adjust the position if necessary.



Hull/Engine Hood

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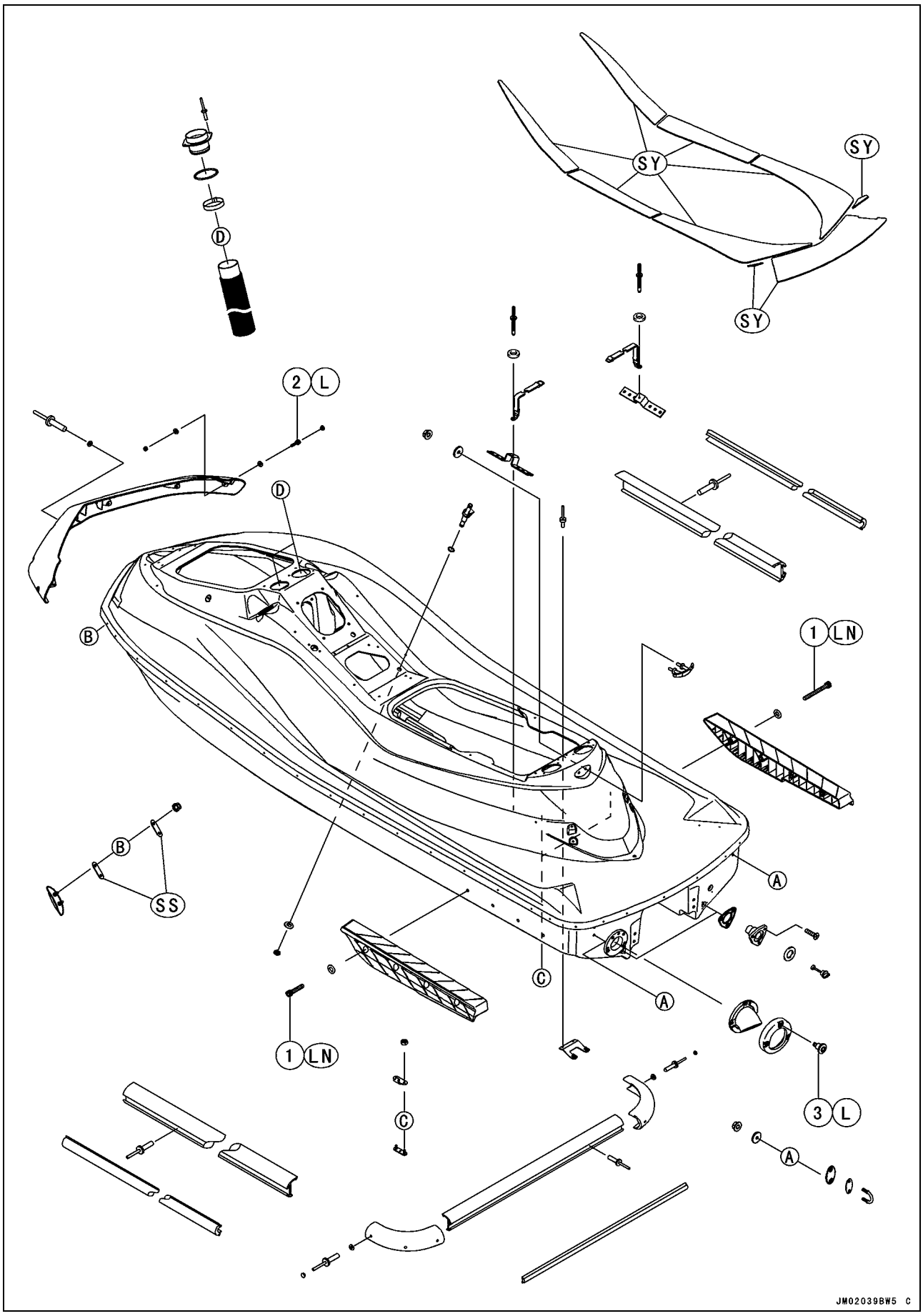
Exploded View

JT1500B7F



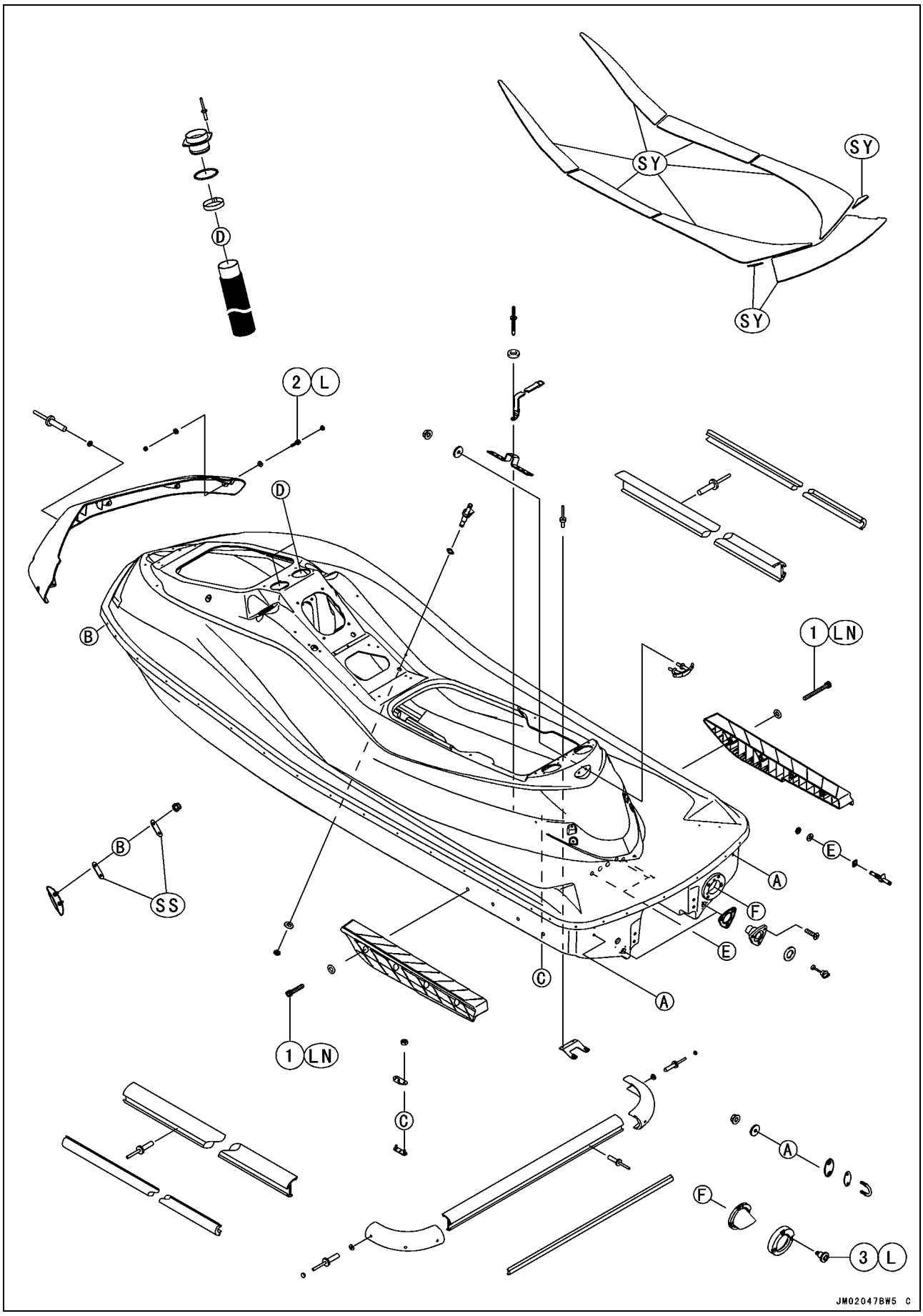
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Stabilizer Bolts	9.8	1.0	87 in·lb	LN
2	Front Bumper Bolts	–	–	–	L
3	Exhaust Outlet Bolts	–	–	–	L

L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
SS: Apply silicone sealant.
SY: Apply synthetic rubber adhesive.

Exploded View

JT1500B8F

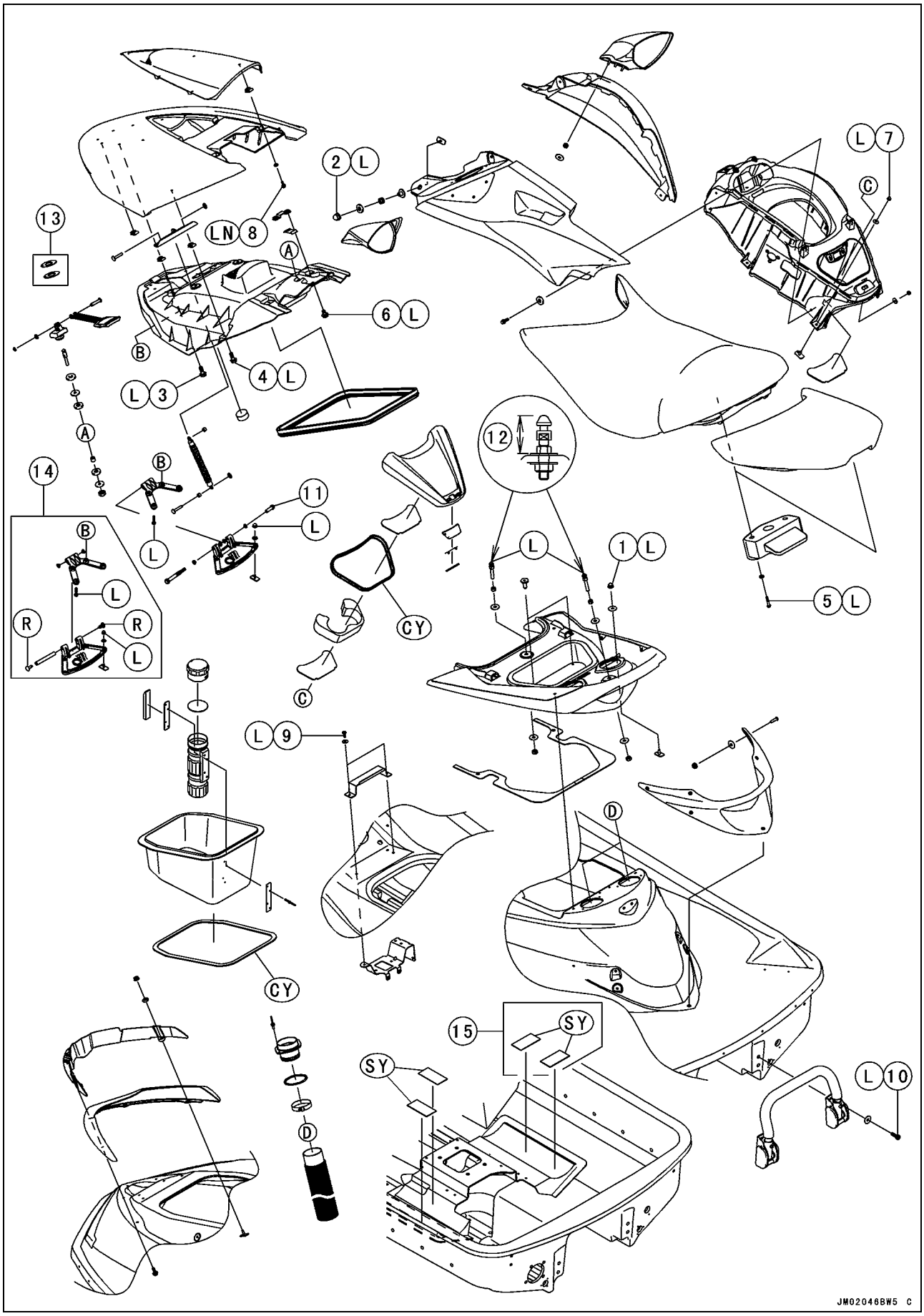


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Stabilizer Bolts	9.8	1.0	87 in·lb	LN
2	Front Bumper Bolts	–	–	–	L
3	Exhaust Outlet Bolts	–	–	–	L

L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
SS: Apply silicone sealant.
SY: Apply synthetic rubber adhesive.

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handrail Plate Nuts	9.8	1.0	87 in·lb	L
2	Side Cover Nuts	–	–	–	L
3	Front Duct Bolts	–	–	–	L
4	Damper Bracket Bolts	–	–	–	L
5	Seat Lock Bolts	–	–	–	L
6	Front Storage Compartment Cover Bolts	–	–	–	L
7	Steering Cover Bolts	–	–	–	L
8	Meter Screen Bolts	–	–	–	LN
9	Bracket Bolts	8.8	0.90	78 in·lb	L
10	Reboarding Step Bolts	–	–	–	L
11	Hinge Shaft Nut	15.7	1.60	11.6	

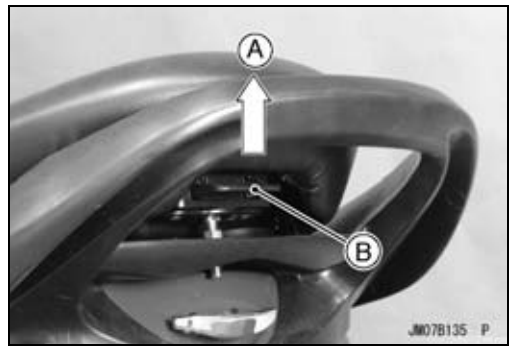
12. JT1500B7F Model: Set the height of the pins to 40 mm (1.6 in.).
    JT1500B8F Model: Set the height of the pins to 42 ±1 mm (1.7 ±0.04in.).
13. EUR Model
14. JT1500B8F Model (late model)
15. JT1500B7F Model

CY: Apply cyanoacrylate cement.
L: Apply a non-permanent locking agent.
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).
SY: Apply synthetic rubber adhesive.

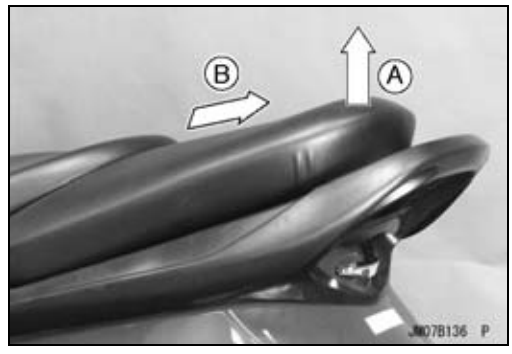
Fittings

Seat Removal

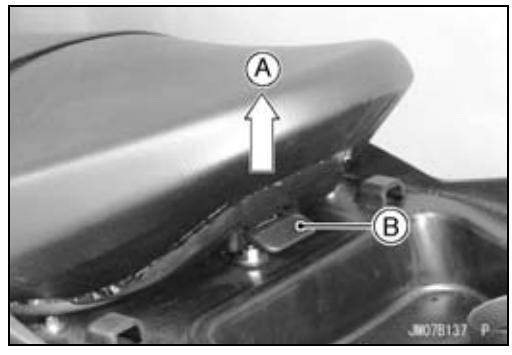
- Pull up [A] the latch handle [B].



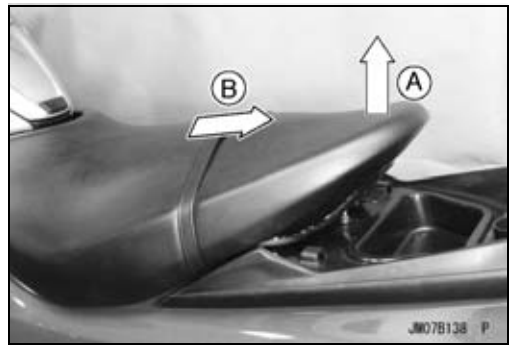
- Remove the rear seat up [A] and to the rear [B].



- Pull up [A] the latch handle [B].

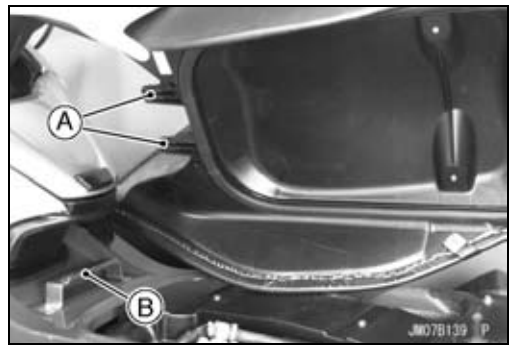


- Remove the front seat up [A] and to the rear [B].



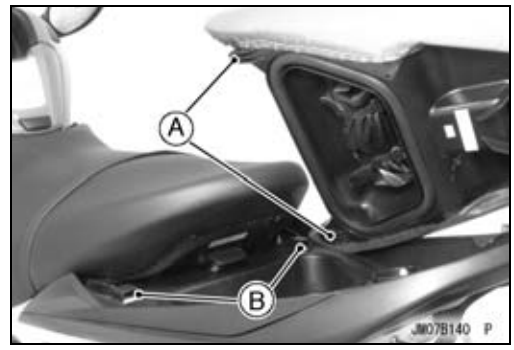
Seat Installation

- Insert the seat hook [A] into the bracket [B] on the deck and slide it all the way forward by pushing the rear of the seat.
- Push down on the rear of the seat to lock it.



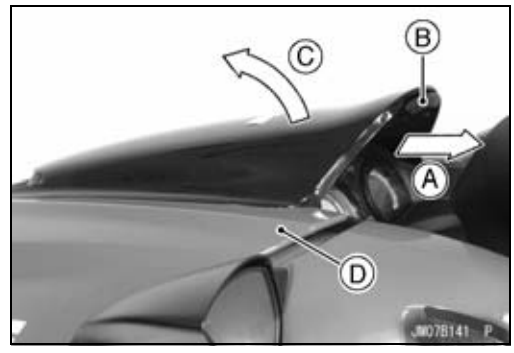
Fittings

- Insert the seat hook [A] into the brackets [B] on the handrail plate and slide it all the way forward by pushing the rear of the seat.
- Push down on the rear of the seat to lock it.

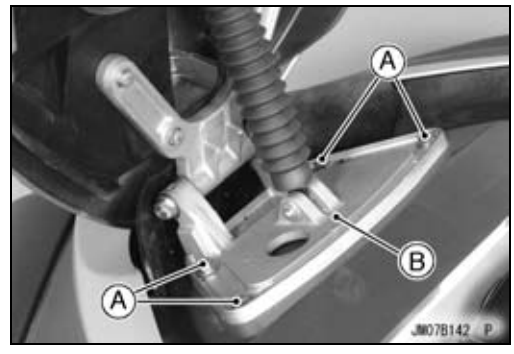


Front Storage Compartment Cover Removal

- Pull [A] the latch handle [B].
- Open [C] the front storage compartment cover [D].

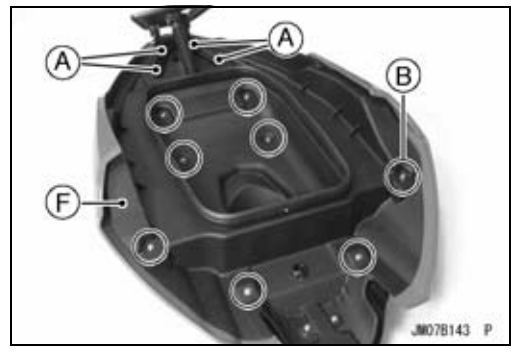


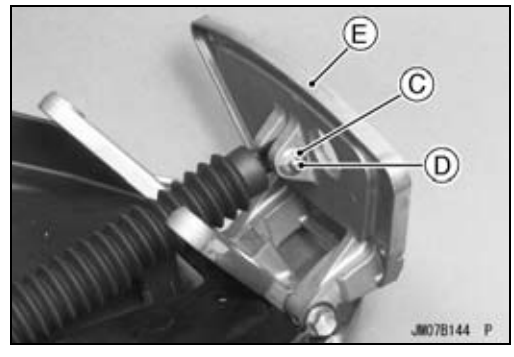
- Remove:
  Hinge Bracket Nuts [A] and Washers
  Front Storage Compartment Cover Assembly [B]



Front Storage Compartment Cover Disassembly

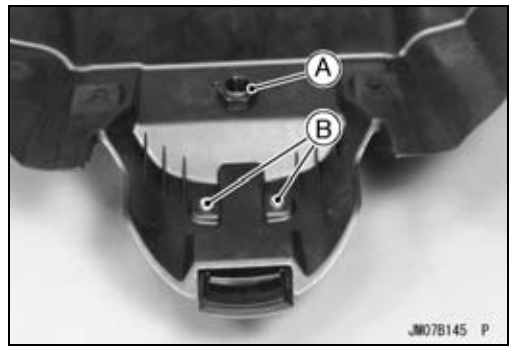
- Remove:
  Hinge Bolts [A]
  Front Duct Bolts [B]
  Damper Washer [C]
  Damper Pin [D]
  Hinge [E]
  Front Duct [F]

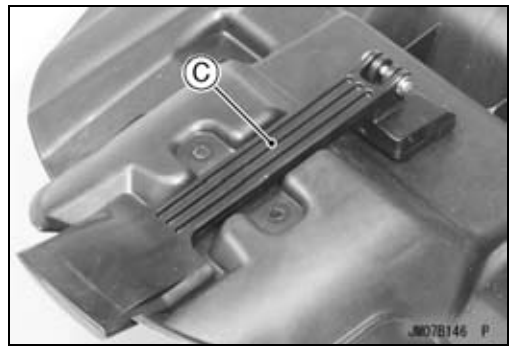




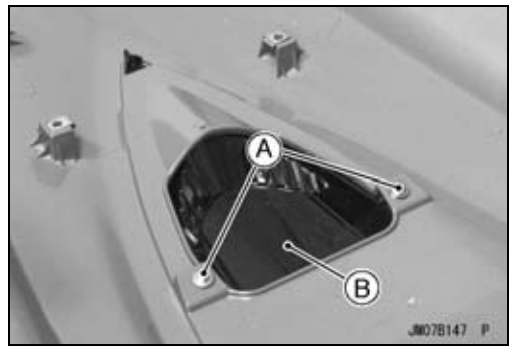
Fittings

- Remove:
  Lock Assembly Nut [A]
  Lock Assembly Bolts [B]
  Bracket
  Lock Assembly [C]



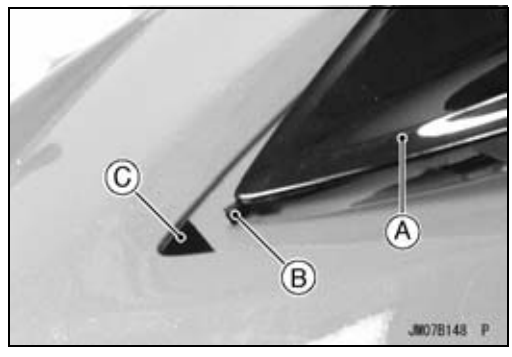


- Remove:
  Screen Bolts [A]
  Screen [B]

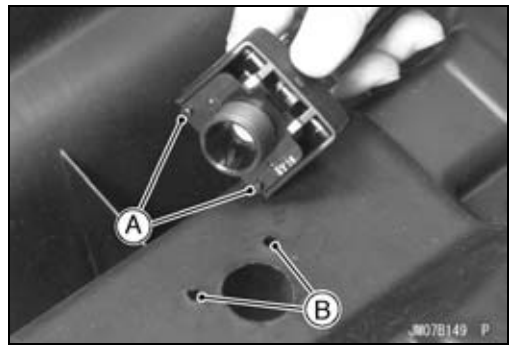


Front Storage Compartment Cover Assembly

- When installing the screen [A] on the front storage compartment cover, insert its projection [B] into the recess [C] on the front storage compartment cover.
- Apply a non-permanent locking agent to the screen bolts and the damper bracket bolts, and tighten them securely.

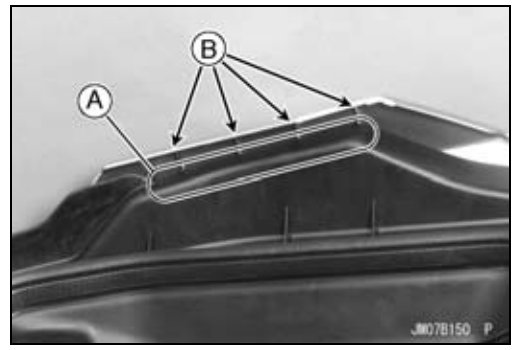


- Align the projections [A] on the lock assembly with the holes [B] on the duct.
- Apply a non-permanent locking agent to lock assembly bolts and tighten them securely.

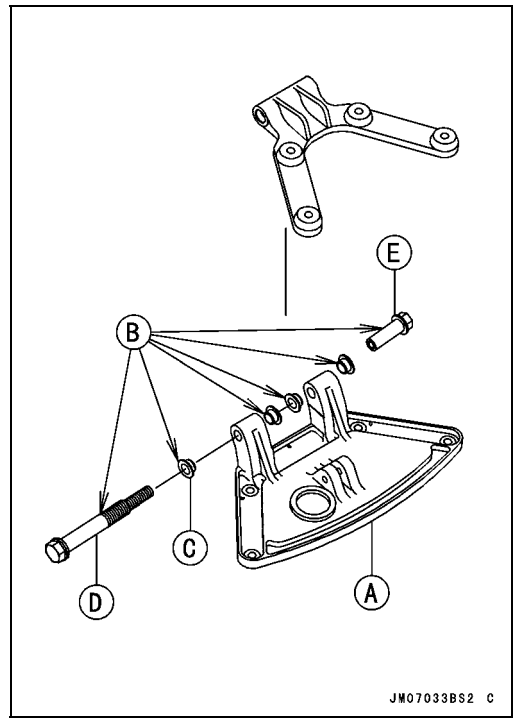


Fittings

- Insert the front duct portions [A] indicated in the figure into the ribs [B] of the front storage cover.
- Apply a non-permanent locking agent to the front duct bolts and tighten them securely.



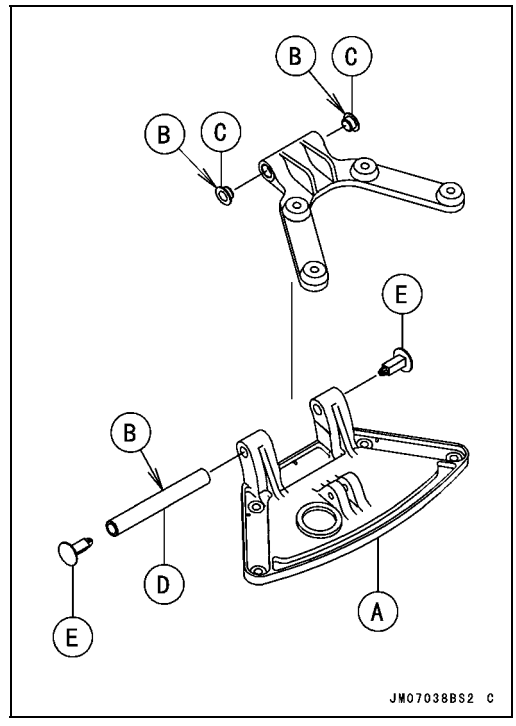
- If the hinge bracket [A] is disassembled, apply a water -resistant grease [B] to the following.
  Bushings [C]
  Shaft [D]
  Nut [E]



- JT1500B8F Model (late model)

○If the hinge bracket [A] is disassembled, apply a water -resistant grease [B] to the following.
  Bushings [C]
  Shaft [D]

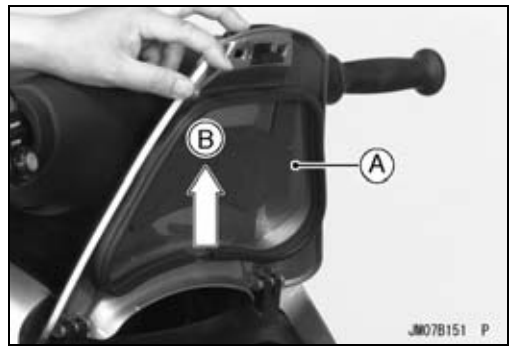
○Replace the rivets [E] with new ones.



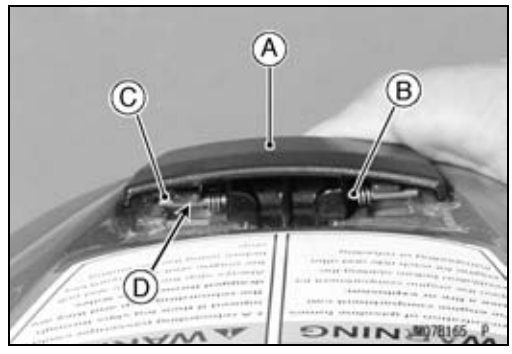
Fittings

Center Storage Lid Removal/Installation

- Open the middle storage lid [A].
- Pull up [B] the lid.
- Installation is the reverse of removal.



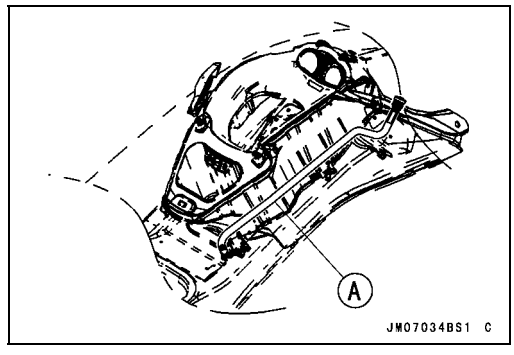
- To remove the lock [A] from the center storage lid, turn and pull out the shaft [B] (both side).
- When installing the shafts, push the shaft end [C] (both side) into the hollow [D] on the lock.



Side Cover Removal

- To remove the right side cover, remove the following.
  Center storage Lid (see Center Storage Lid Removal/Installation)
  Side Cover Nuts [A] and Washers

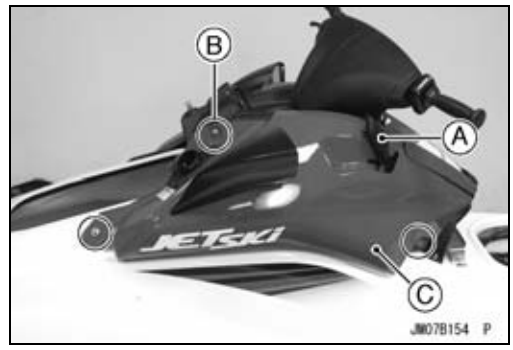
- Disconnect the rear end [A] of the flushing line.



- To remove the left side cover, remove the following.
- Remove the fuel filler cap [A].

Fittings

- Pull up the tilt lever [A].
- Take out the side cover nuts [B] and washers, remove the left side cover [C].



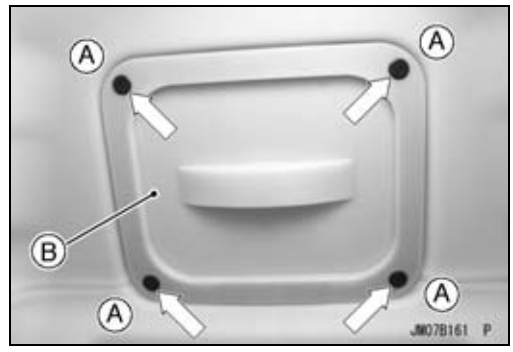
Side Cover Installation

- Installation is the reverse of removal, noting the following.

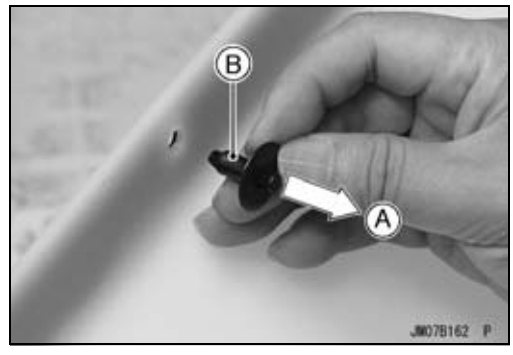
○Be sure that the rear end of flushing line is connected with its fitting surely.

Front Access Cover Removal/Installation

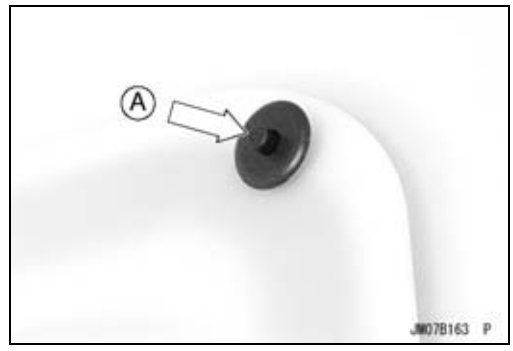
- Open the front storage compartment cover.
- Remove the front storage case.
- Push in the pins [A] and remove the front access cover [B].



- To install the front access cover, pull up the pin head [A] as shown and install the rivet [B].



- Push in [A] the pin.



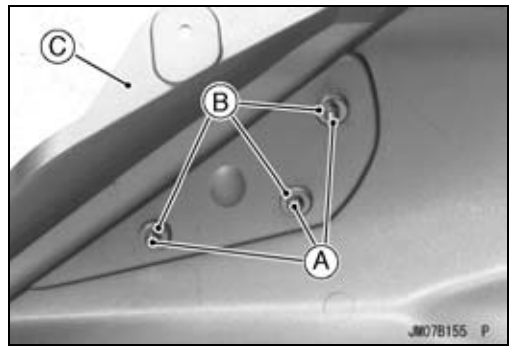
Fittings

Center Access Cover Removal/Insatallation

- Remove the steering cover (see Steering Removal).
- Pull out the center access cover [A].

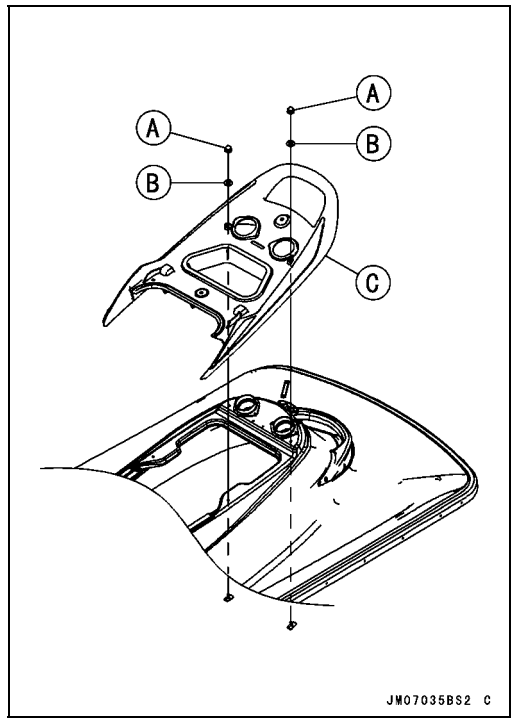
Mirror Removal/Installation

- Remove the side cover (see Side Cover Removal).
- Unscrew the nuts [A] and washers [B] and remove the mirrors [C] (both sides).
- Installation is the reverse of removal.



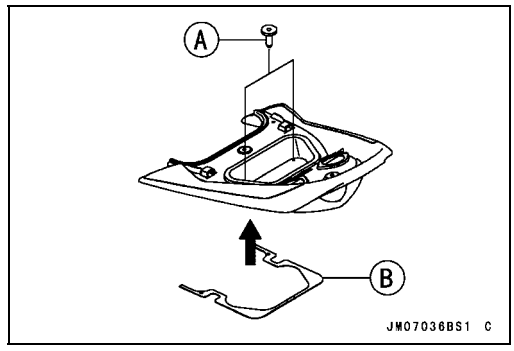
Handrail Plate Removal

- Remove the rear and front seats (see Seat Removal).
- Take out the handrail plate nuts [A] and washers [B], and remove the handrail plate [C].



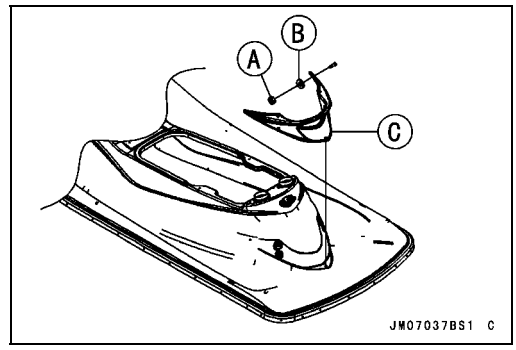
Handrail Plate Installation

- Be sure that the plugs [A] and the damper [B] are in position.



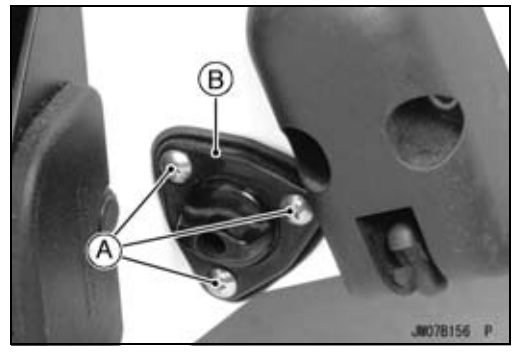
Fittings

Handrail Removal/Installation



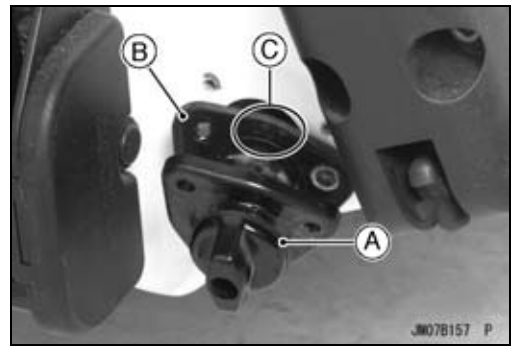
- Remove the rear and front seats (see Seat Removal).
- Disconnect the bilge hoses from the breather fitting.
- Remove the rear air ducts (see Air Duct Removal).
- Take out the nuts [A] and washers [B], remove the handrail [C].

Drain Plug Housing Removal



- Unscrew the screws [A] and remove the drain plug housing [B].

Drain Plug Housing Installation

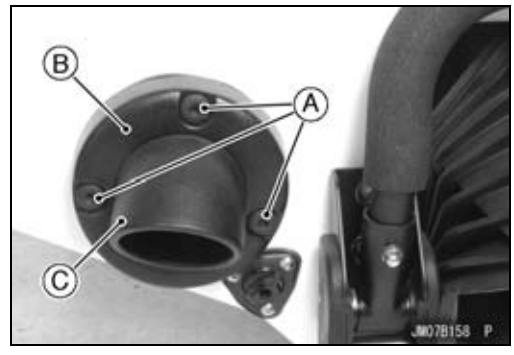


- Check the seal [A] for damage.

★If necessary, replace new ones.

○Install the new gasket [B] so that its “OUT” mark [C] faces outwards.

Exhaust Outlet Removal



- Unscrew the mounting bolts [A] and remove the holder [B] and exhaust outlet [C].

○The exhaust outlet is located at the left of the hull in JT1500B7F model, however it is located at right of the hull in JT1500B8F model.

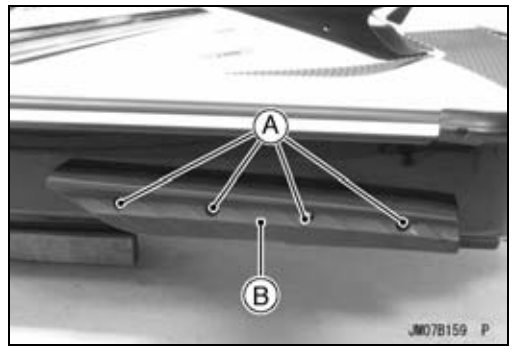
Exhaust Outlet Installation

- Apply a non-permanent locking agent to the mounting bolts and tighten them securely.

Fittings

Stabilizer Removal

- Unscrew the stabilizer bolts [A] and remove the stabilizer [B].



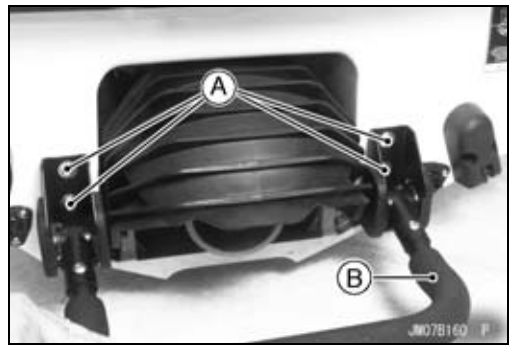
Stabilizer Installation

- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the stabilizer bolt and torque them.

Torque - Stabilizer Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Reboarding Step Removal

- Unscrew the reboarding step bolts [A] and remove the reboarding step [B].



Reboarding Step Installation

- Apply a non-permanent locking agent to the reboarding step bolts and tighten them securely.

Hull Replacement

To replace the hull, remove the various parts in the following suggested order.

Battery and Pad
Exhaust Pipe
Inlet Manifold
Engine and Mounts
Air Filter
Water Box Muffler
Drive Shaft and Shaft Holder
Pump and Hoses
Steering Cover
Handlebar and Steering
Steering Cable
Reverse Cable
Fuel Tank and Filler
Bilge and Cooling System Hose
Bypass Hose and Outlet
Bumpers
Engine Hood Latch
Front Storage Compartment Cover and Brackets
Air Ducts
Handrail

The following parts cannot be removed from the hull and must be replaced.

Decals
Labels
Mats
Registration Number (if any)

If the new hull is to be painted, do that first. Then install removed parts in the reverse order of their removal. Finally, install the labels, decals, mats and the registration numbers.

Rubber Parts

NOTE

○*The rubber parts on the watercraft are fastened in place with various adhesives. To replace a rubber part, use a cement in the following table, or an equivalent.*

⚠ WARNING

Read all warnings and cautions on any solvents and adhesives used. Many of these products are flammable, may be harmful to the skin and eyes, and may give off harmful vapors. Use these solvents and adhesives only in a well-ventilated area and never near an open flame.

For this Application	Type
Mats Front and Rear Seats Gasket Front Storage Compartment Cover Gasket	Synthetic Rubber Adhesive (P/N: 92104-3701)
Detents Handlebar Grips	Cyanoacrylate Cement

CAUTION

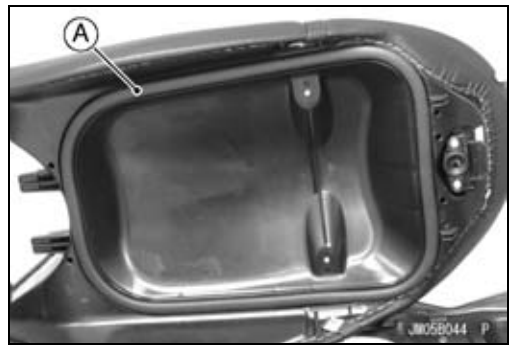
Be very careful that the part is positioned correctly when you apply the cement. It may be impossible to reposition the part.

⚠ WARNING

Do not get any cyanoacrylate cement in your eyes or on your skin. If you do get some in your eyes, do not try to wash it out. Contact a physician immediately! If you do get some on your fingers, do not touch any other part of your body; your fingers will stick to anything they touch. Allow the cement to cure and it will eventually wear off.

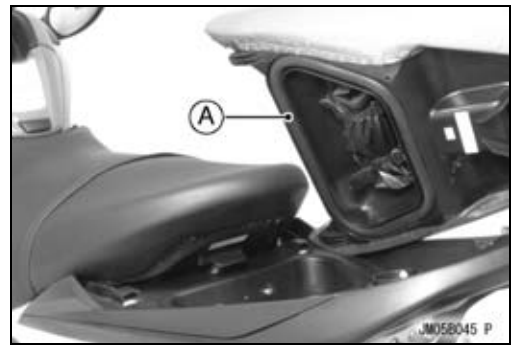
Rubber Parts Location

Front Seat Gasket [A]



Rubber Parts

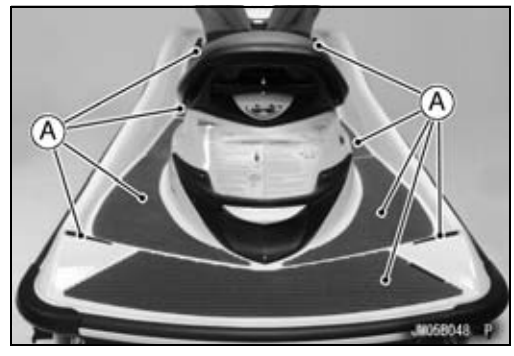
Rear Seat Gasket [A]



Front Storage Compartment Gasket [A]

Center Storage Compartment Gasket [A]

Mats [A]



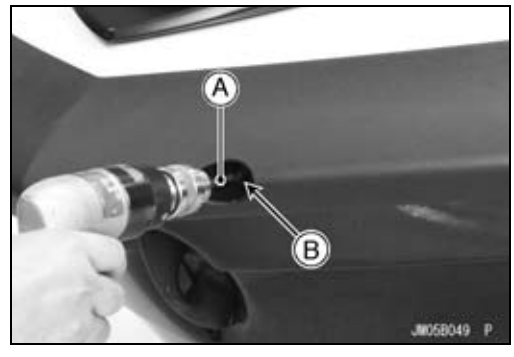
Rivet Removal

● Drill out the rivet with a drill bit [A] of the correct size.

Rivet Removal Drill Bit Size
5.0 mm (0.2 in.)

NOTE

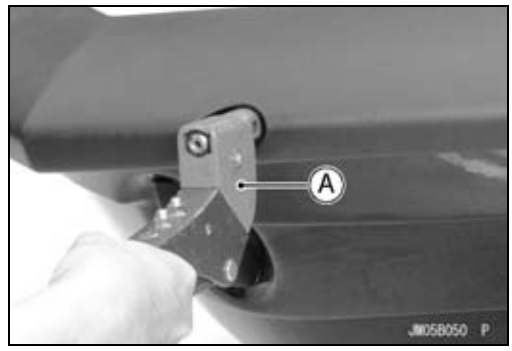
○*Stop drilling when the rivet head [B] starts to turn with drill bit.*
○*Tap the rivet out with a suitable punch and hammer.*



Rubber Parts

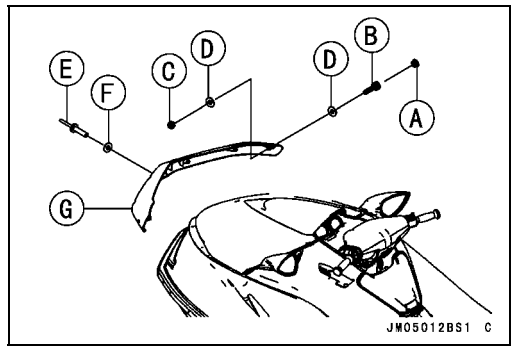
Rivet Installation

- Secure the parts to the hull with the rivets using a riveter [A].



Front Bumper Removal

- Take out the plugs [A].
- Take out the mounting bolts [B], nuts [C] and washers [D].
- Drill out the rivets [E] and washers [F] (see Rivet Removal).
- Remove the front bumper [G].

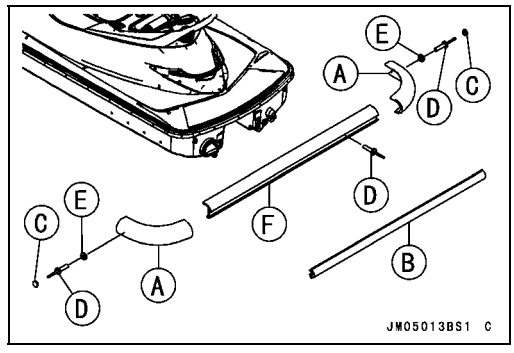


Front Bumper Installation

- Secure the front bumper to the hull flange with the rivets (see Rivet Installation).

Rear Bumper Removal

- Remove the corner bumpers [A] and trim strip [B].
  - ○Take out the plugs [C].
  - ○Drill out the rivets [D] and washers [E] (see Rivet Removal).
- Remove the rear bumper [F].

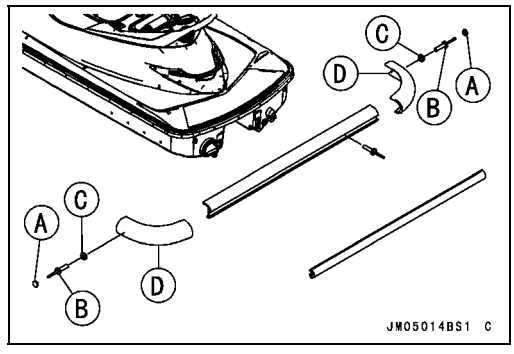


Rear Bumper Installation

- Secure the bumpers to the hull flange with the rivets (see Rivet Installation).

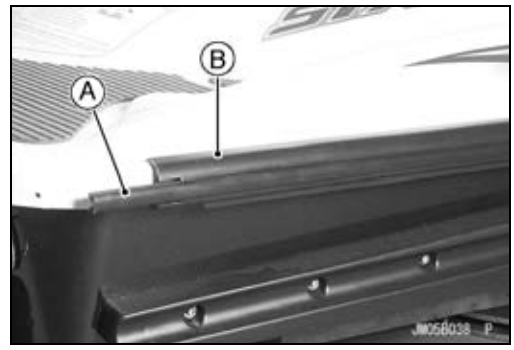
Side Bumper Removal

- Take out the plugs [A].
- Drill out the rivets [B] and washers [C] (see Rivet Removal).
- Remove the corner bumper [D].

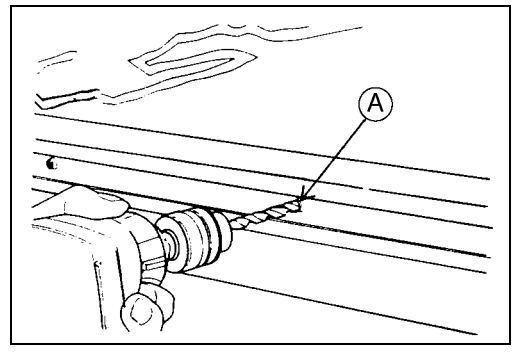


Rubber Parts

- Remove the trim strip [A] from the side bumper [B].



- Drill out the rivets [A] (see Rivet Removal).

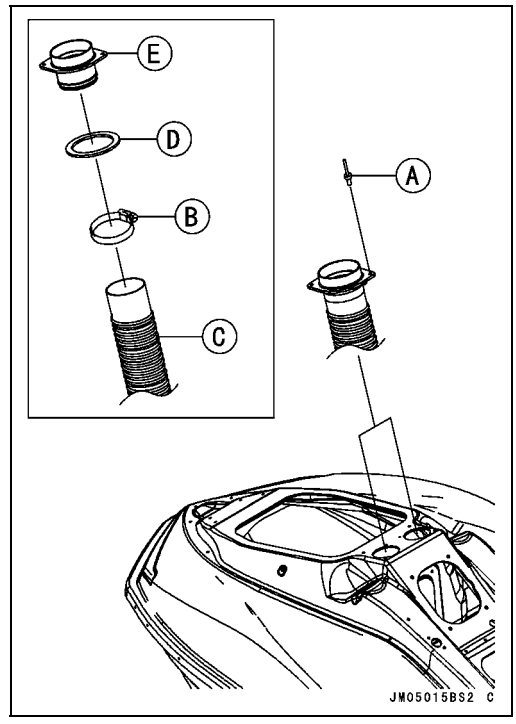


Side Bumper Installation

- Secure the side bumpers to the hull flange with the rivets (see Rivet Installation).
- Install the trim strip.

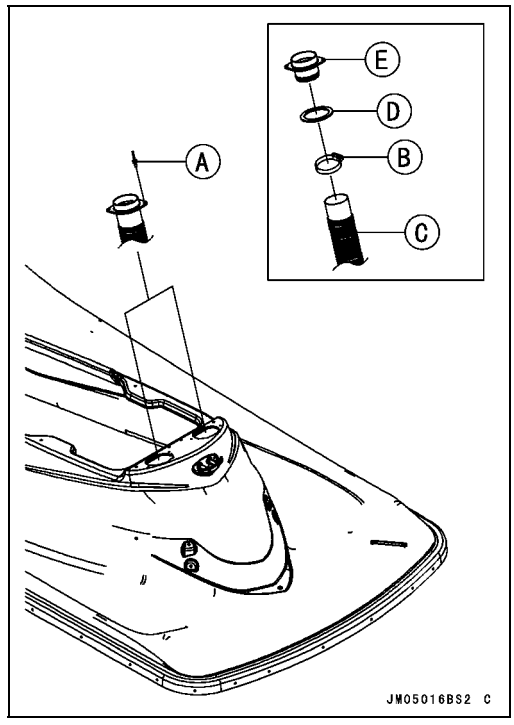
Air Duct Removal

- To remove the front air ducts from the deck, remove the steering cover (see Steering Removal in the Steering chapter).
- Drill out the rivets [A] (see Rivet Removal).
- Remove:
  Clamp [B]
  Front Air Duct [C]
  Damper [D]
  Duct [E]



Rubber Parts

- To remove the rear air ducts from the deck, remove the handrail plate (see Handrail Plate Removal).
- Drill out the rivets [A] (see Rivet Removal).
- Remove:
  Clamp [B]
  Rear Air Duct [C]
  Damper [D]
  Duct [E]



Air Duct Installation

- Secure the air duct to the deck with the rivets (see Rivet Installation).

Electrical System

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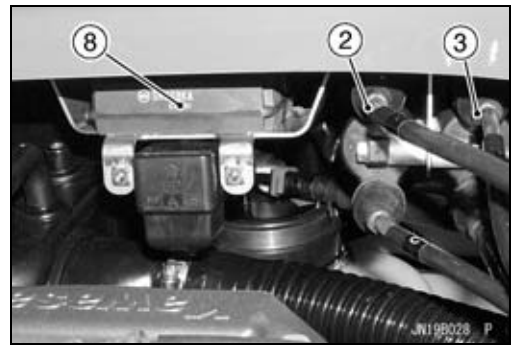
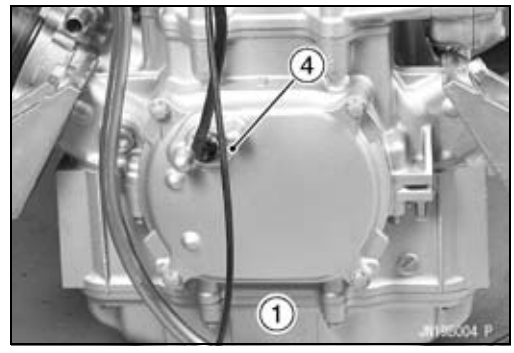
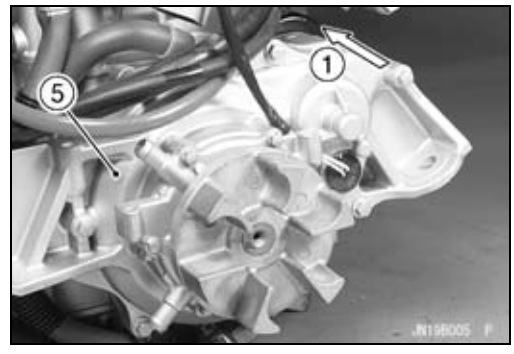
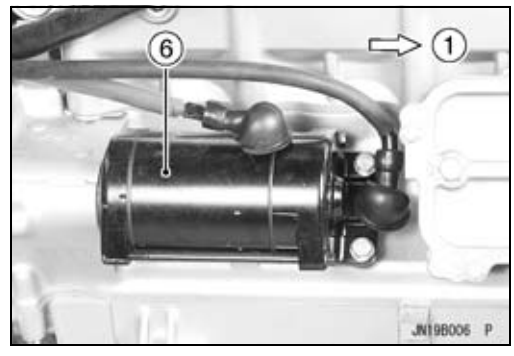
Parts Location

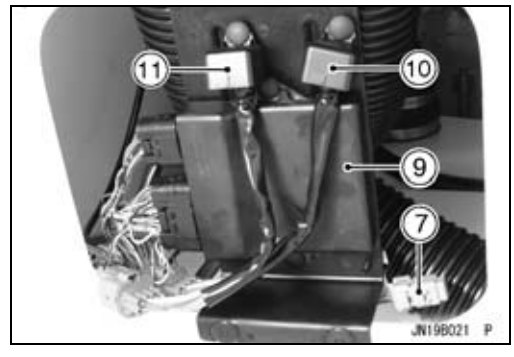
1. Bow
2. Ignition Coil #2, #3
3. Ignition Coil #1, #4
4. Crankshaft Sensor
5. Magneto
6. Starter Motor
7. Fuse Case
8. Regulator/Rectifier
9. ECU (Electronic Control Unit)
10. ECU Main Relay
11. Fuel Pump Relay





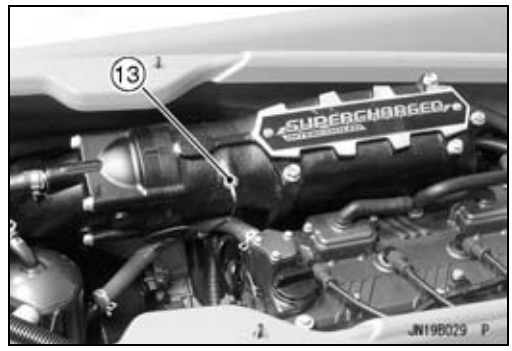


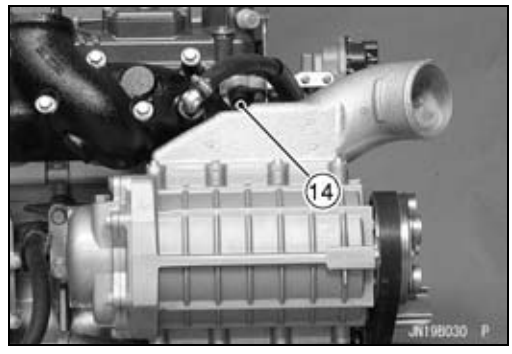


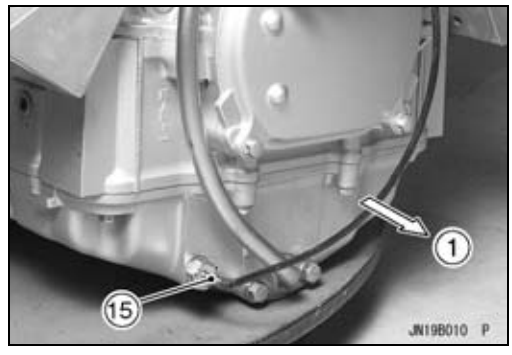


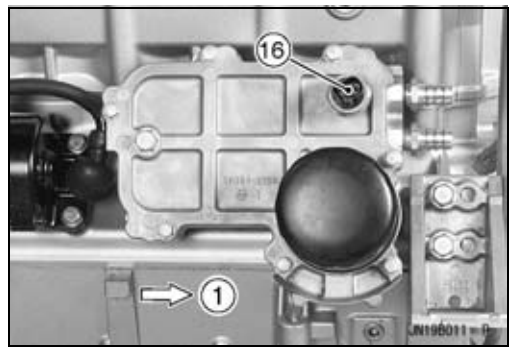
Parts Location

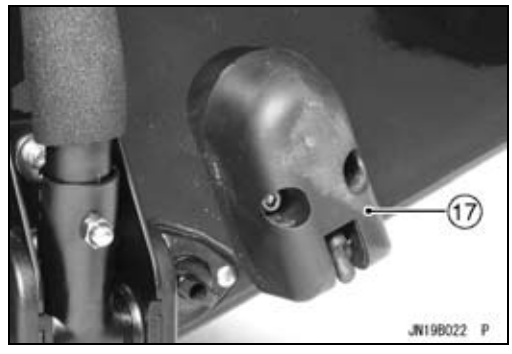
13. Water Temperature Sensor
14. Camshaft Position Sensor
15. Oil Temperature Sensor
16. Oil Pressure Switch
17. Speed Sensor (The speed sensor is located at the right of the hull in JT1500B7F model, however it is located at left of the hull in JT1500B8F model).





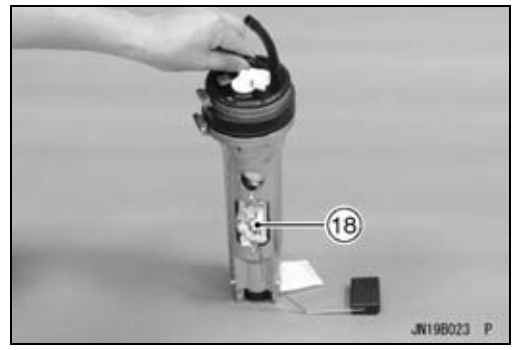


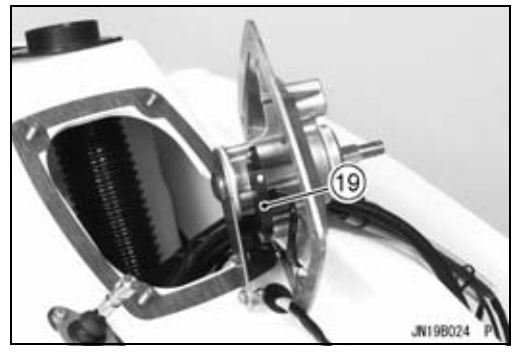


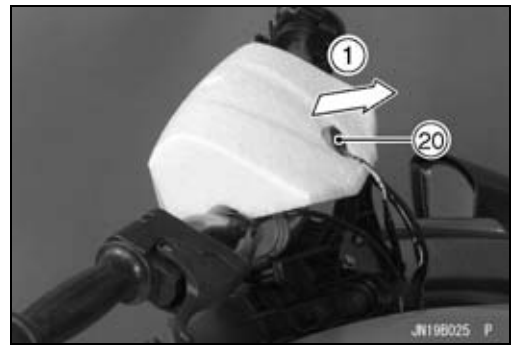


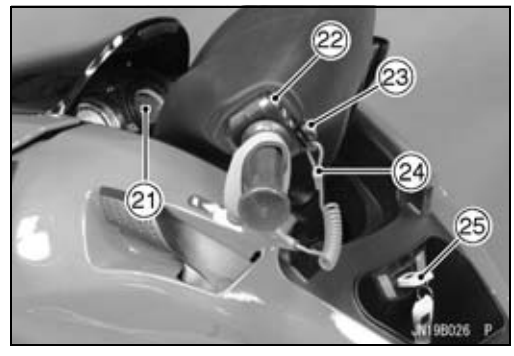
Parts Location

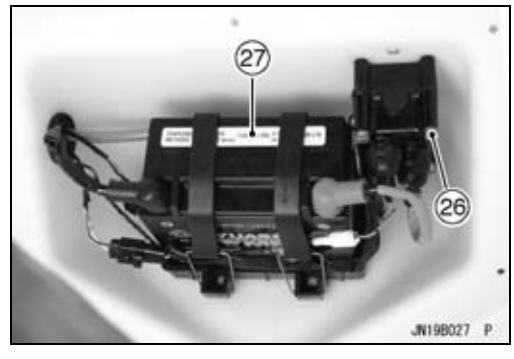
18. Fuel Level Sensor
19. Steering Position Sensor
20. Buzzer
21. Multifunction Meter
22. Starter Switch
23. Engine Stop Switch
24. Lanyard Key (Tether Code)
25. Ignition Switch
26. Starter Relay
27. Battery



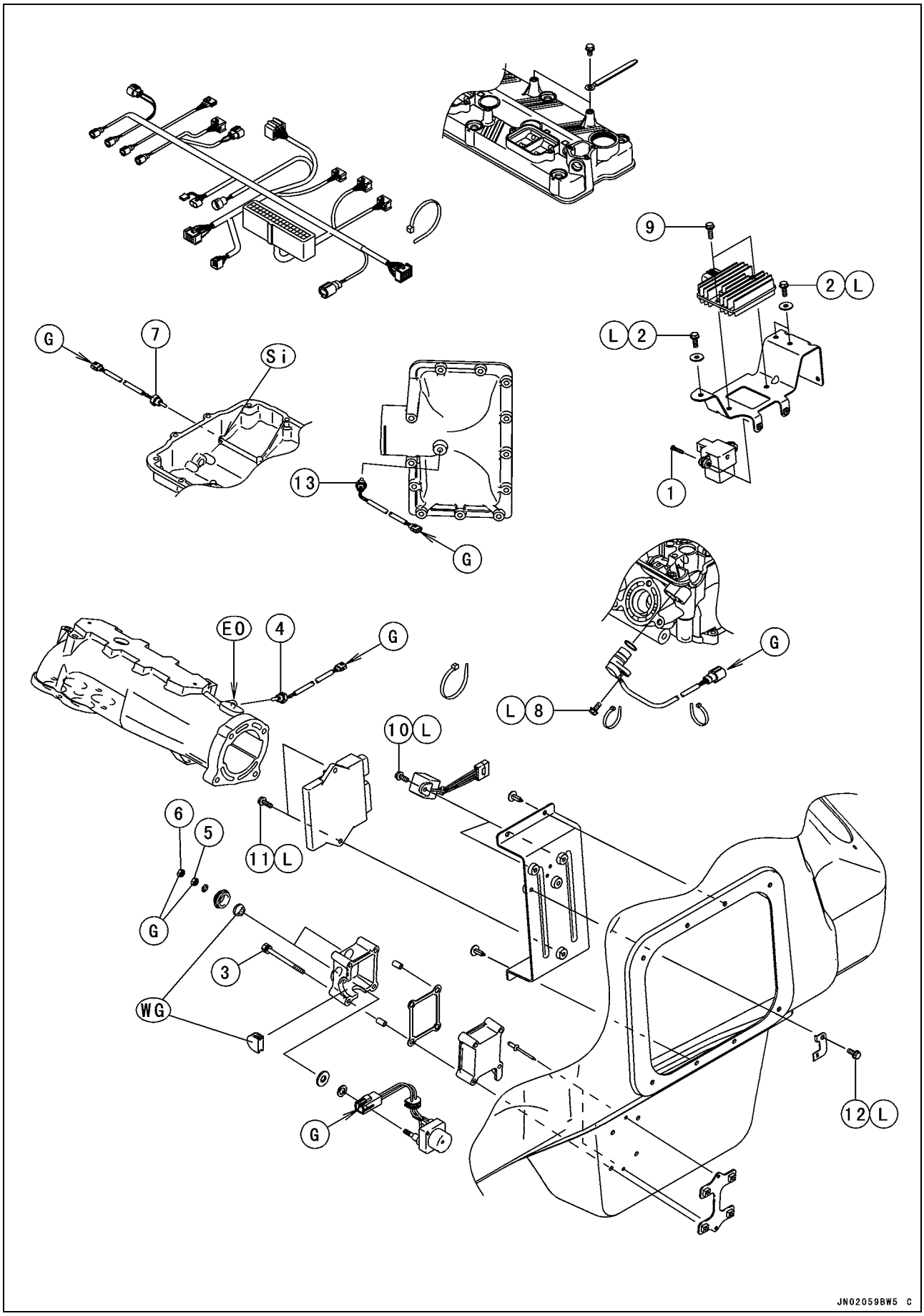








Exploded View

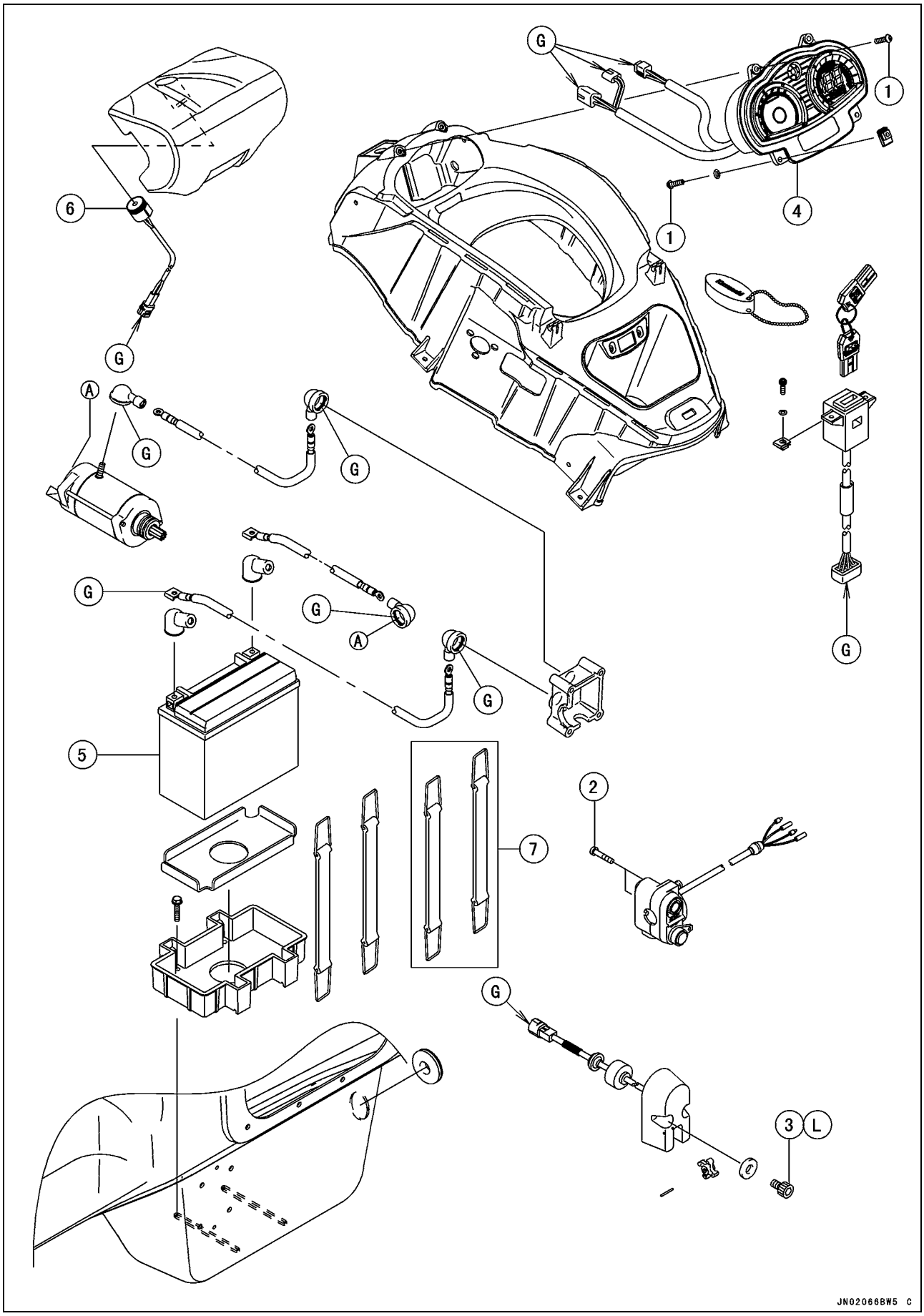


Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
2	Bracket Bolts	8.8	0.90	78 in·lb	L
3	Starter Relay Case Bolts	7.8	0.80	69 in·lb	
4	Water Temperature Sensor	15	1.5	11	see text
5	Starter Relay Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
6	Starter Cable Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
7	Oil Temperature Sensor	15	1.5	11	see text
8	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
9	Regulator/Rectifier Bolts	7.8	0.80	69 in·lb	
10	Relay Bolts	2.5	0.25	22 in·lb	L
11	ECU Mounting Bolts	3.0	0.30	27 in·lb	L
12	Fuse Bracket Bolt	2.5	0.25	22 in·lb	L
13	Charging Temperature Sensor	15	1.5	11	

EO: Fill the hollow of the exhaust manifold with engine oil (10W-30).
G: Apply grease.
L: Apply a non-permanent locking agent.
Si: Fill the hollow of the oil pan with the specified silicone grease (Kawasaki Bond: 92137-1002).

Exploded View



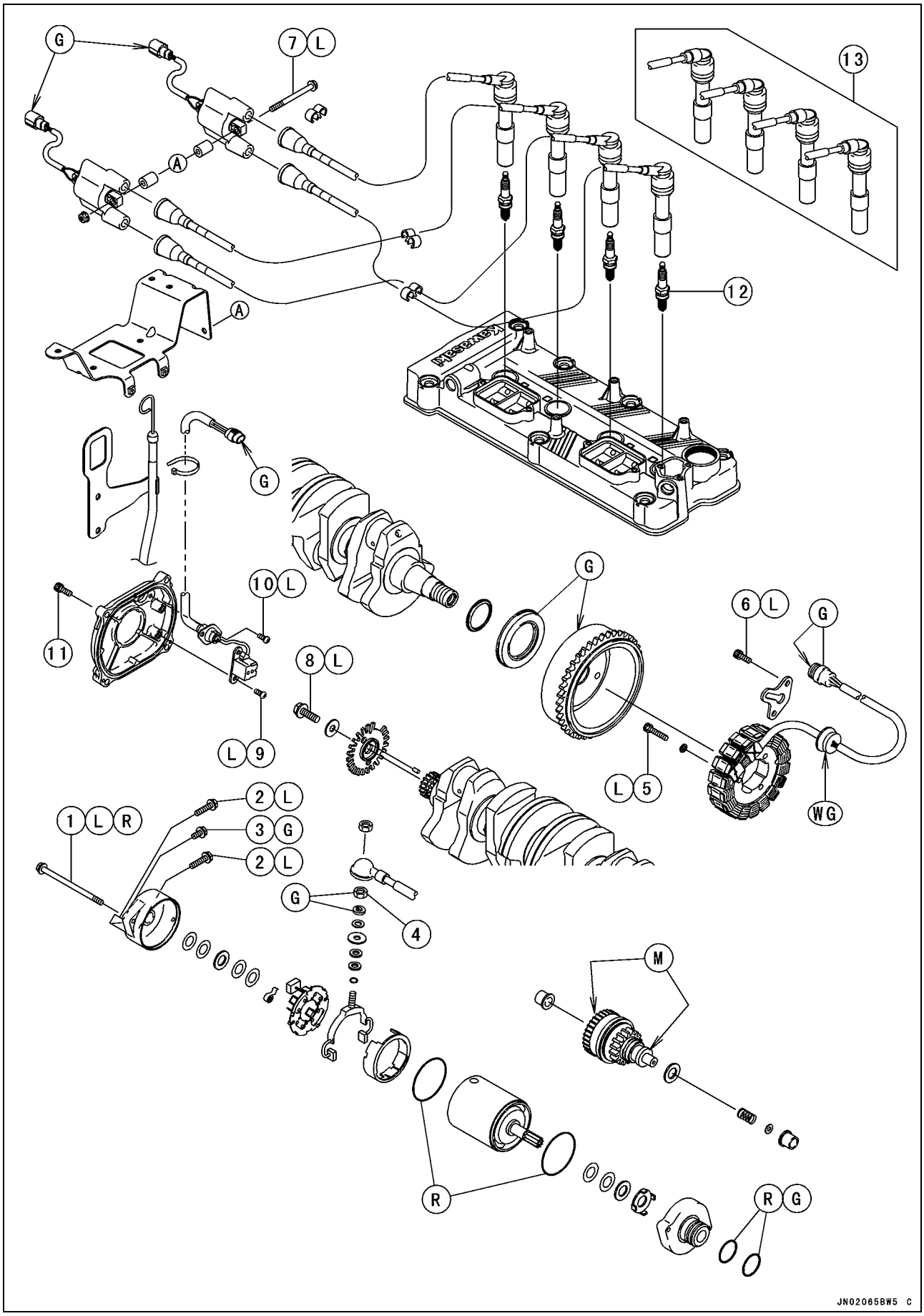
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Multifunction Meter Mounting Bolts	3.9	0.40	35 in·lb	
2	Start/stop Switch Case Mounting Screw	3.9	0.40	35 in·lb	
3	Speed Sensor Mounting Bolts	3.9	0.40	35 in·lb	L

4. Multifunction Meter
5. Battery
6. Buzzer
7. EUR Model

G: Apply grease.

Exploded View

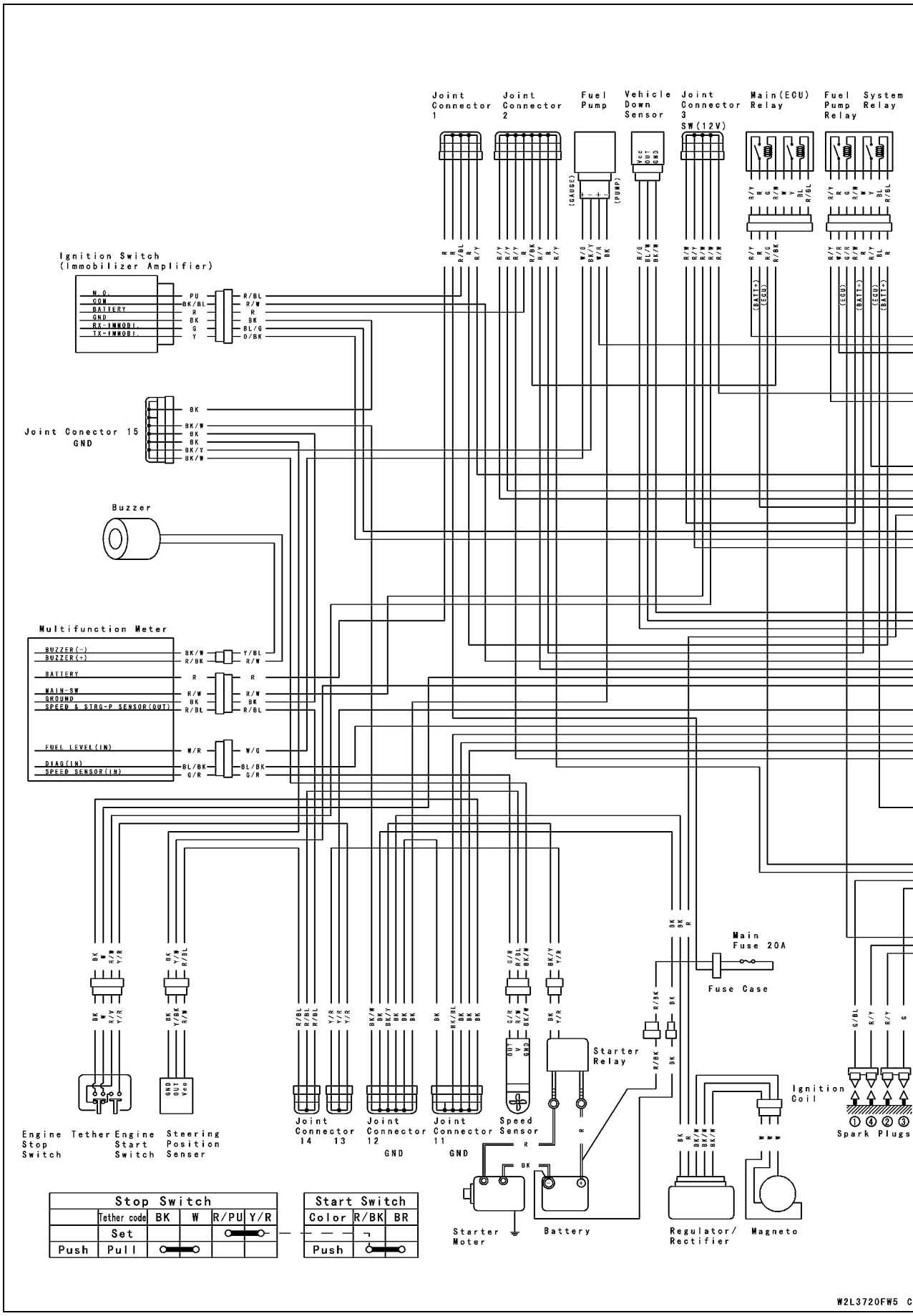


Exploded View

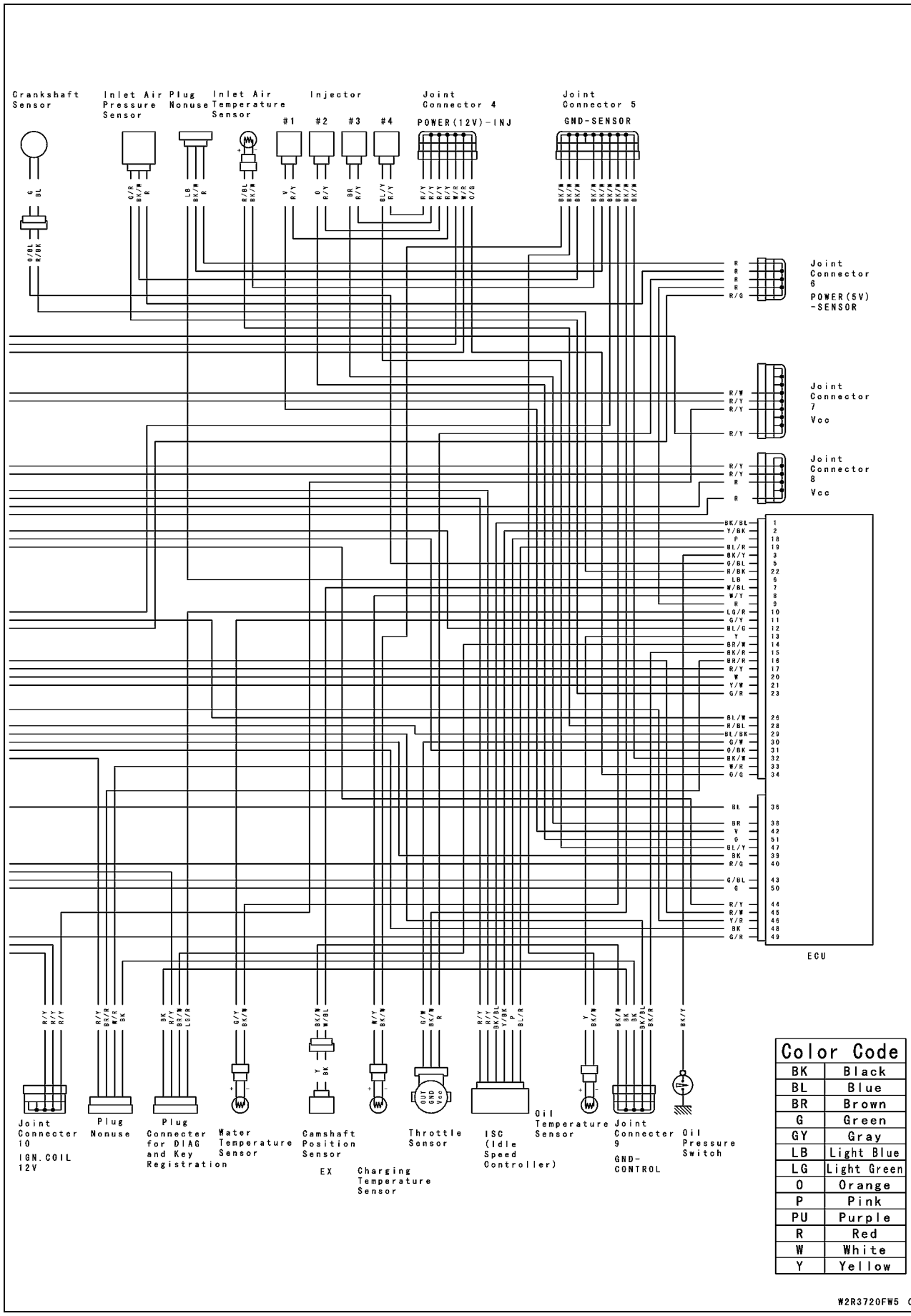
No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter Motor Through Bolts	6.4	0.65	56 in·lb	L, R
2	Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	L
3	Starter Motor Ground Bolt	8.8	0.90	78 in·lb	
4	Starter Motor Terminal Nut	8.8	0.90	78 in·lb	
5	Stator Coil Bolts	12	1.2	104 in·lb	L
6	Grommet Holder Bolts	8.8	0.90	78 in·lb	L
7	Ignition Coil Mounting Bolts	8.8	0.90	78 in·lb	L
8	Timing Rotor Bolt	20	2.0	14	L
9	Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
10	Rubber Grommet Holder Screws	4.4	0.45	39 in·lb	L
11	Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
12	Spark Plugs	13	1.3	113 in·lb	

13. JT1500B7F Model
G: Apply grease.
L: Apply a non-permanent locking agent.
M: Apply molybdenum disulfide grease.
R: Replacement parts.
WG: Apply water resistant grease.

Wiring Diagram



Wiring Diagram

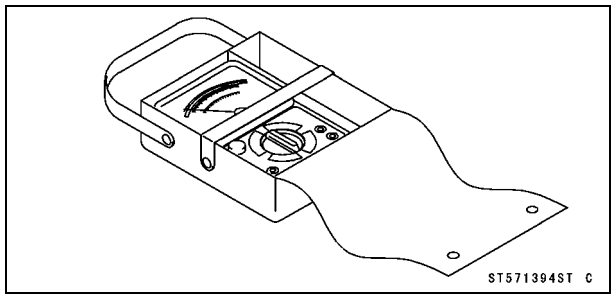


Specifications

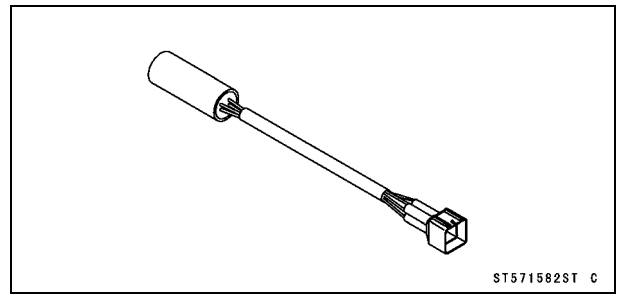
Item	Standard	Service Limit
Battery		
Type	12 V 18 Ah	– – –
Electric Starter System		
Starter Motor:		
Brush Length	12 mm (0.4724 in.)	6.5 mm (0.2559 in.)
Commutator Diameter	28 mm (1.1024 in.)	27 mm (1.063 in.)
Charging System		
Regulator/rectifier Output Voltage	Battery Voltage 14 ~ 15 V	– – –
Alternator Output Voltage	48 ~ 72 V	– – –
Stator Coil Resistance	0.432 ~ 0.648 Ω	– – –
Ignition System		
Ignition Coil:		
Primary Winding Resistance	1.53 ~ 2.07 Ω	– – –
Secondary Winding Resistance	12.50 ~ 16.91 kΩ	– – –
Spark Plug:		
Type	NGK PMR9B	– – –
Gap	0.6 ~ 0.7 mm (0.024 ~ 0.028 in.)	– – –
Crankshaft Sensor Resistance	408 ~ 612 Ω	– – –

Special Tools and Sealant

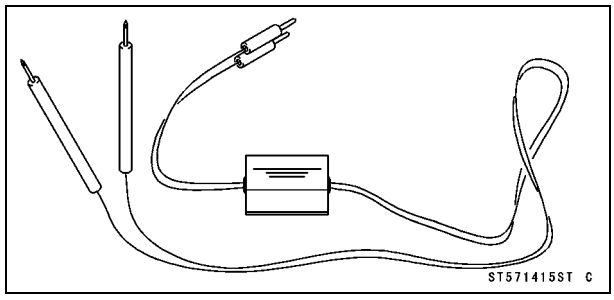
Hand Tester:
57001-1394



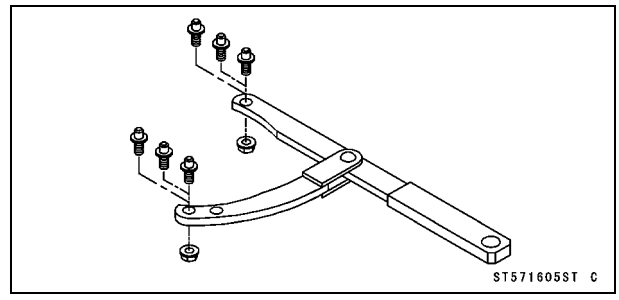
Key Registration Unit:
57001-1582



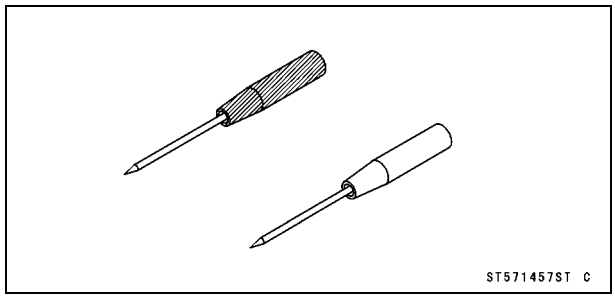
Peak Voltage Adapter:
57001-1415



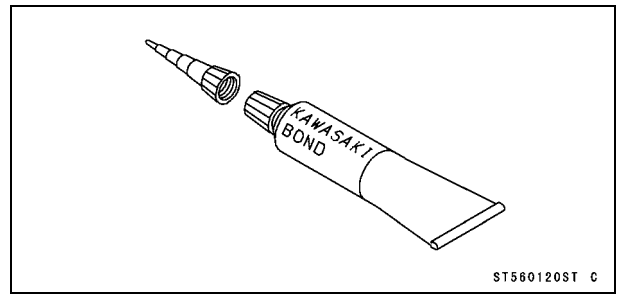
Flywheel & Pulley Holder:
57001-1605



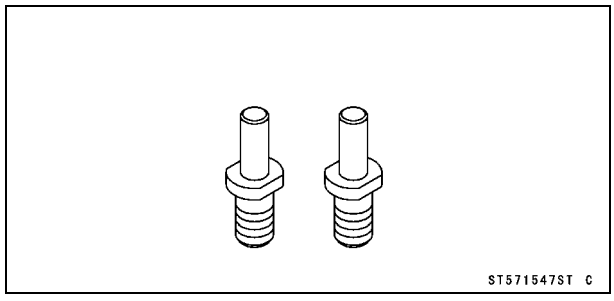
Needle Adapter Set:
57001-1457



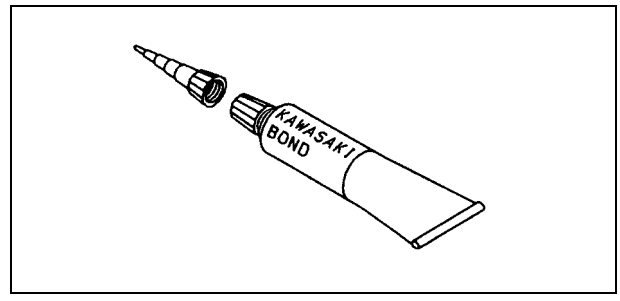
Kawasaki Bond (Silicone Sealant):
56019-120



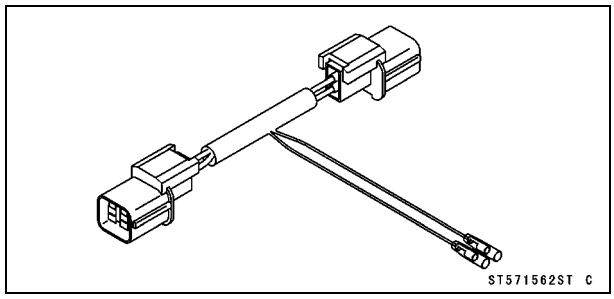
Holder Attachment:
57001-1547



Kawasaki Bond (Silicone Grease):
92137-1002



Harness Adapter:
57001-1562



Precautions

There are a number of important precautions that should be followed servicing electrical systems.

- ○Do not reverse the battery cable connections. This will burn out the diodes on the electrical parts.
- ○Always check battery condition before condemning other parts of an electrical system. A fully charged battery is a must for conducting accurate electrical system tests.
- ○The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- ○To prevent damage to electrical parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.
- ○Because of the large amount of current, never keep the starter button pushed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- ○Do not use a meter illumination bulb rated for other than voltage or wattage specified in the wiring diagram, as the meter or gauge panel could be warped by excessive heat radiated from the bulb.
- ○Take care not to short the leads that are directly connected to the battery positive (+) terminal to the chassis ground.
- ○Troubles may involve one or in some cases all items.

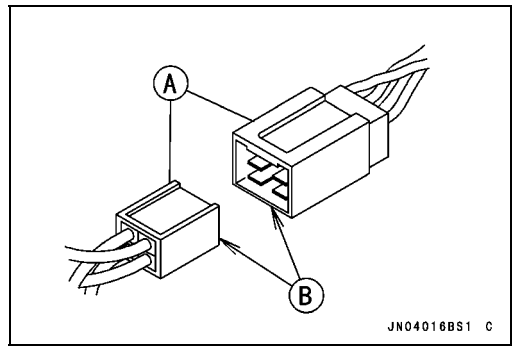
Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they must be repaired or replaced, or the new replacement will soon fail again

- ○Make sure all connectors in the circuit are clean and tight, and examine leads for signs of burning, fraying, etc. Poor leads and bad connections will affect electrical system operation.
- ○Measure coil and winding resistance when the part is cold (at room temperature).

Color Codes

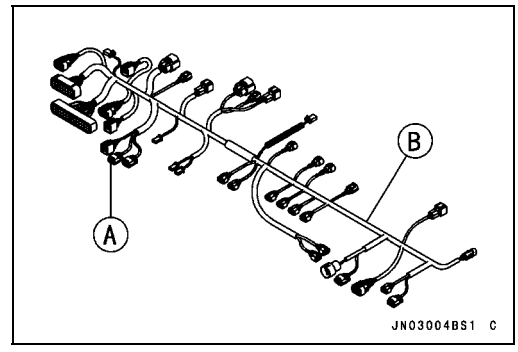
BK: Black	LG: Light Green
BL: Blue	O: Orange
BR: Brown	P: Pink
CH: Chocolate	PU: Purple
DG: Dark Green	R: Red
G: Green	W: White
GY: Gray	Y: Yellow
LB: Light Blue	

- ○Connect the connectors with the same colored [A] and the same number of pins [B] connectors.



Electrical Wiring

Wiring Inspection



- Visually inspect the wiring for signs of burning, fraying, etc.

★If any wiring is poor, replace the damaged wiring.

- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.

★If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.

- Check the wiring for continuity.

○Use the wiring diagram to find the ends of the lead which is suspected of being a problem.

○Connect the hand tester between the ends of the leads.

Special Tool - Hand Tester: 57001-1394

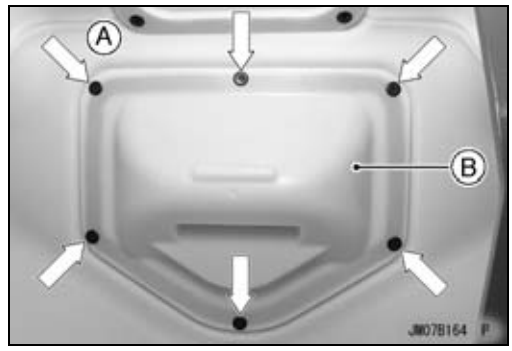
○Set the tester to the × 1 Ω range, and read the tester.

★If the tester does not read 0 Ω, the lead is defective. Replace the lead or the wiring harness [B] if necessary.

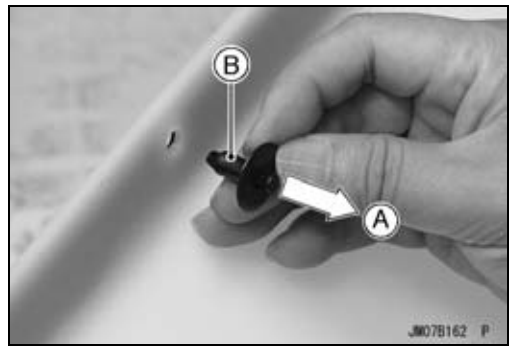
Battery

Battery Cover Removal/Installation

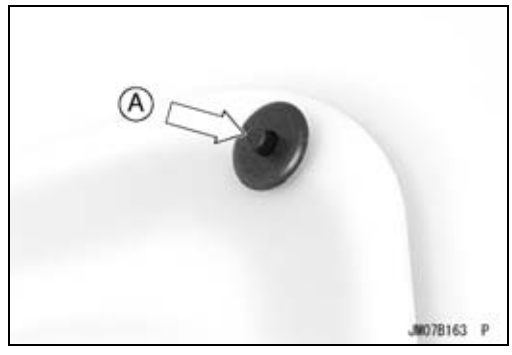
- Open the front storage compartment cover.
- Remove the front storage case.
- Push in the pins [A] and remove the battery cover [B].



- To install the battery cover, pull up the pin head [A] as shown and install the rivet [B].



- Push in [A] the pin.



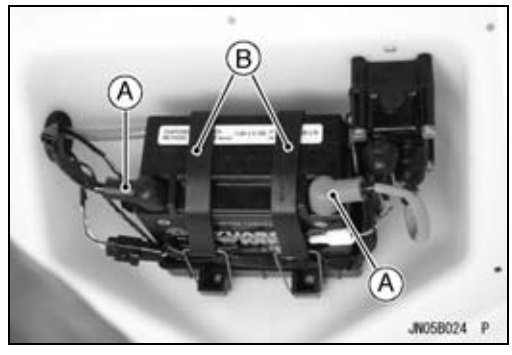
Battery Removal

- Disconnect the battery cables [A].

⚠ WARNING

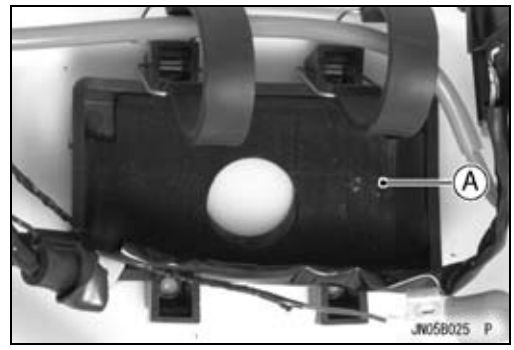
To prevent possible personal injury and damage to electrical components, always disconnect the grounded cable first.

- Unhook the battery straps [B].
- Carefully lift the battery from the battery compartment.



Battery

Battery Installation



- Be sure the battery damper [A] is in position in the battery compartment.
- Hook the battery straps.
- Connect the battery cables, positive first.

○After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.

○Slide the protective boot over each terminal.

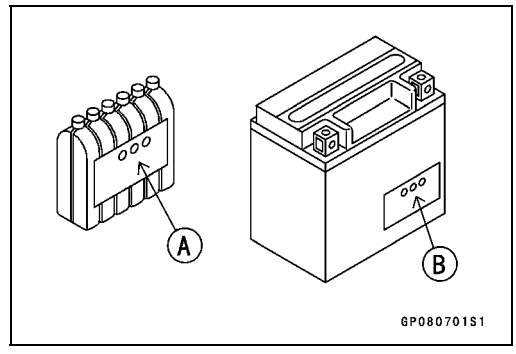
⚠ WARNING

Loose battery cables can create sparks which can cause a fire or explosion resulting in injury or death. Make sure the battery terminal screws are tightened securely and the covers are installed over the terminals.

CAUTION

Do not reverse the battery connections.

Electrolyte Filling

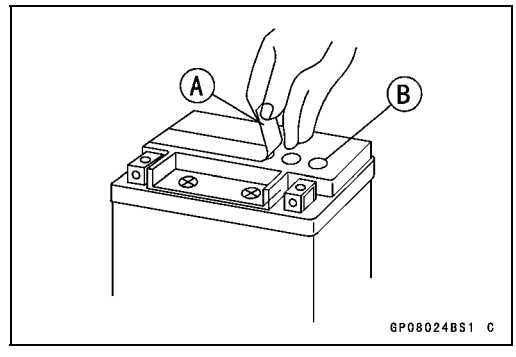


- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name for JT1500B7F: YTX20L-BS

CAUTION

Be sure to use the electrolyte container with the same model name as the battery since the electrolyte volume and specific gravity vary with the battery type. This is to prevent overfilling of the electrolyte, shorting the battery life, and deterioration of the battery performance.



- Check to see that there is no peeling, tears or holes in the seal sheet on the top of the battery.
- Place the battery on a level surface.
- Remove the seal sheet [A].

CAUTION

Do not remove the seal sheet sealing the filler ports [B] until just before use.

NOTE

○*A battery whose seal sheet has any peeling, tears, or holes, requires a refreshing charge (initial charge).*

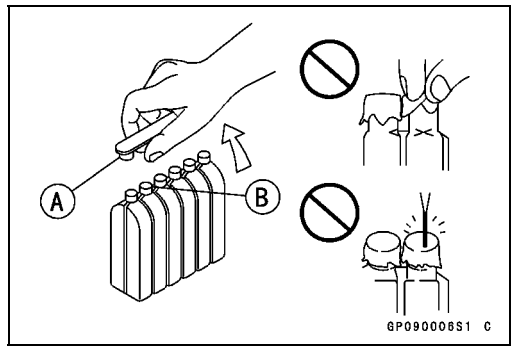
Battery

- Take the electrolyte container out of the vinyl bag.
- Detach the strip of cap [A] from the container.

NOTE

○*Do not discard the strip of cap because it is used as the battery plugs later.*

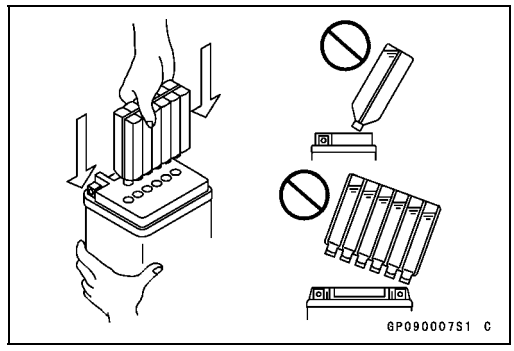
○*Do not peel back or pierce the seals [B] on the container.*



- Place the electrolyte container upside down aligning the six seals with the six battery filler ports.
- Push the container down strongly enough to break the seals. Now the electrolyte should start to flow into the battery.

NOTE

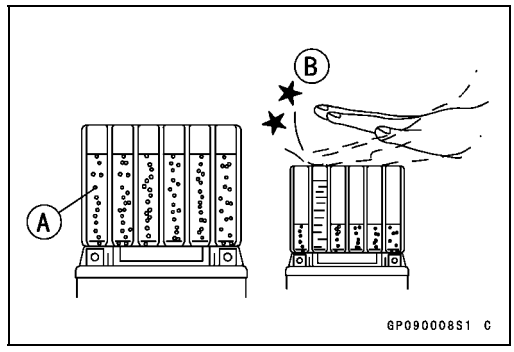
○*Do not tilt the container as the electrolyte flow may be interrupted.*



- Check the electrolyte flow.

★If no air bubbles [A] are coming up from the filler ports, or if the container cells have not emptied completely, tap the container [B] a few times.

- Keep the container in place for **20** minutes or more. Don't remove the container from the battery until it is empty, the battery requires all the electrolyte from the container for proper operation.



CAUTION

Removal of the container before it is completely empty can shorten the service life of the battery. Do not remove the electrolyte container until it is completely empty and 20 minutes have elapsed.

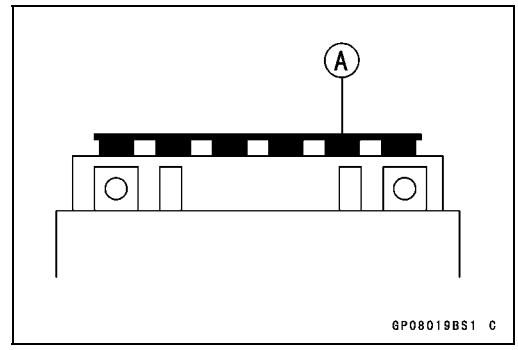
- Gently remove the container from the battery.
- Let the battery sit for **60** minutes prior to charging to allow the electrolyte to permeate into the plates for optimum performance.

NOTE

○*Charging the battery immediately after filling can shorten service life. Let the battery sit for at least **60** minutes after filling.*

Battery

Initial Charge



- Place the strip [A] of caps loosely over the filler ports.
- Newly activated sealed batteries require an initial charge.

Standard Charge 1.8 A × 5 ~ 10 hours

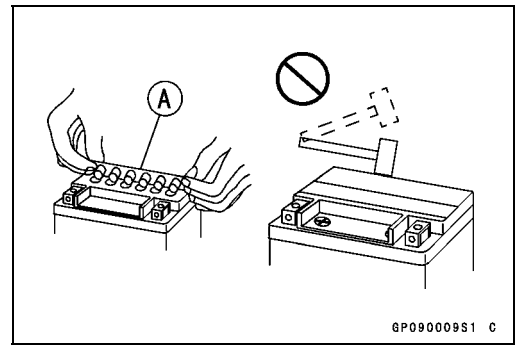
★If using a recommended battery charger, follow the charger's instructions for newly activated sealed battery.

Kawasaki-recommended chargers
Optimate III
Yuasa 1.5 Amp Automatic Charger
Battery Mate 150-9

★If the above chargers are not available, use equivalent one.

NOTE

○*Charging rates will vary depending on how long the battery has been stored, temperature, and the type of charger used. Let battery sit 30 minutes after initial charge, then check voltage using a voltmeter. If it is not at least 12.6 volts, repeat charging cycle.*



- After charging is completed, press down firmly with both hands to seat the strip of caps [A] into the battery (don't pound or hammer). When properly installed, the strip of the caps will be level with the top of the battery.

CAUTION

Once the strip of the caps [A] is installed onto the battery, never remove the caps, nor add water or electrolyte to the battery.

NOTE

○*To ensure maximum battery life and customer satisfaction, it is recommended the battery be load tested at three times its amp-hour rating for 15 seconds.*
Re-check voltage and if less than 12.6 volts repeat the charging cycle and load test. If still below 12.6 volts the battery is defective.

Precautions

1) No need of topping-up

No topping-up is necessary in this battery until it ends its life under normal use. Forcibly prying off the seal cap to add water is very dangerous. Never do that.

2) Refreshing charge

If an engine will not start, it indicates the battery has been discharged. Give refresh charge for 5 to 10 hours with charge current shown in the specification (see this chapter).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.

CAUTION

This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. However, the battery's performance may be reduced noticeably if charged under conditions other than given above. Never remove the seal cap during refresh charge.
If by chance an excessive amount of gas is generated due to overcharging, the relief valve releases the gas to keep the battery normal.

Battery

3) When you do not use the watercraft for months:
   Give a refresh charge before you store the watercraft and store it with the negative lead removed. Give a refresh charge **once a month** during storage.
4) Battery life:
   If the battery will not start the engine even after several refresh charges, the battery has exceeded its useful life. Replace it (Provided, however, the watercraft's starting system has no problem).

⚠ WARNING

Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger.
This procedure prevents sparks at the battery terminals which could ignite any battery gases.
No fire should be drawn near the battery, or no terminals should have the tightening loosened.
The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water. Get medial attention if severe.

Interchange

A sealed battery can fully display its performance only when combined with a proper watercraft electric system. Therefore, replace a sealed battery only on watercraft which was originally equipped with a sealed battery.

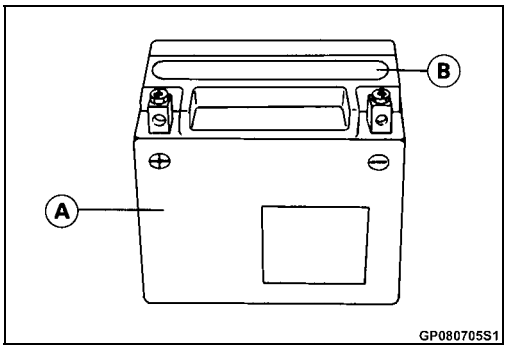
Be careful, if a sealed battery is installed on watercraft which had an ordinary battery as original equipment, the sealed battery's life will be shortened.

Charging Condition Inspection

- Refer to Battery Charging Condition Inspection in the Periodic Maintenance chapter.

Refreshing Charge

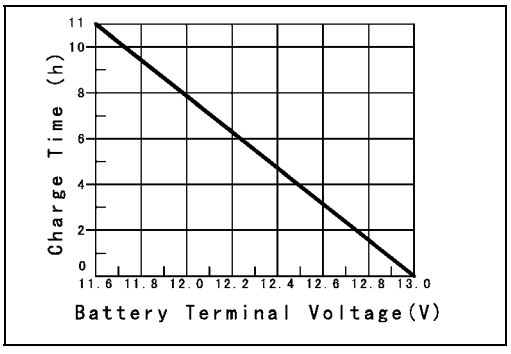
- Remove the battery [A] (see Battery Removal).
- Refresh-charge by following method according to the battery terminal voltage.



⚠ WARNING

This battery is sealed type. Never remove the strip of cap [B] even at charging. Never add water. Charge with current and time as stated below.

Terminal Voltage: 11.5 ~ less than 12.6 V
Standard Charge: 1.8 A × 5 ~ 10 h (see following chart)
Quick Charge: 9.0 A × 1.0 h



CAUTION

If possible, do not quick charge. If the quick charge is done due to unavoidable circumstances, do standard charge later on.

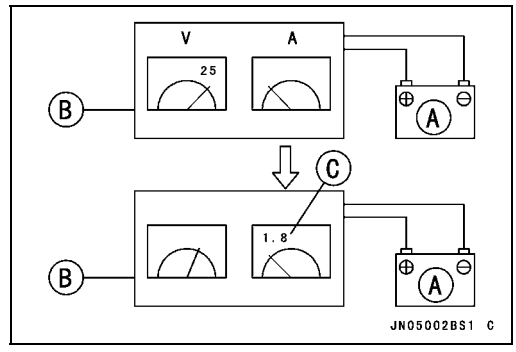
Terminal Voltage: less than 11.5 V
Charging Method: 1.8 A × 20 h

Battery

NOTE

○*Increase the charging voltage to a maximum voltage of 25 V if the battery will not accept current initially. Charge for no more than five minutes at the increased voltage then check if the battery is drawing current.*

○*If the battery will accept current, decrease the voltage and charge by the standard charging method described on the battery case. If the battery will not accept current after 5 minutes, replace the battery.*



Battery [A]
Battery Charger [B]
Standard Value [C]

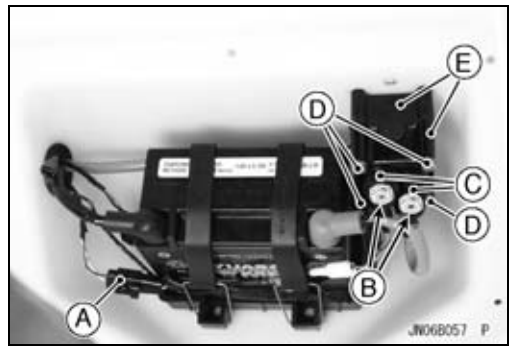
● Determine battery condition after refreshing charge.

○Determine the condition of the battery 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

Criteria	Judgement
12.6 V or more	Good
12.0 ~ less than 12.6 V	Charge insufficient → Recharge
less than 12.0 V	Unserviceable → Replace

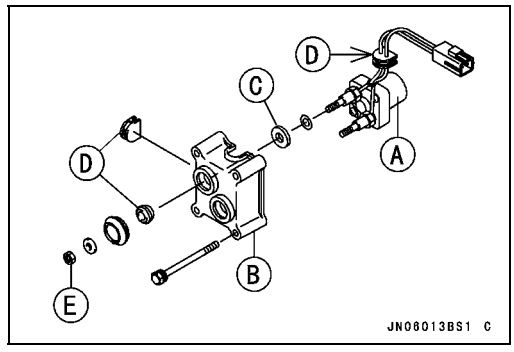
Electric Starter System

Starter Relay Removal



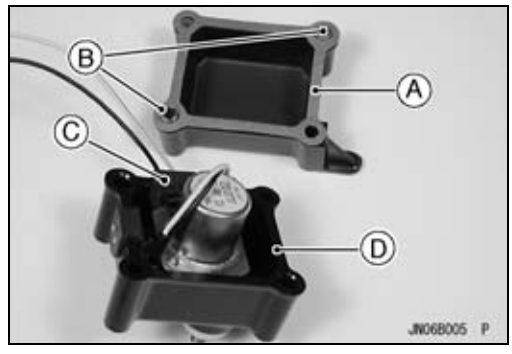
- Remove:
  Battery Cover (see Battery Cover Removal/Installation in the Hull/Engine Hood chapter)
  Battery (see this chapter)
- Disconnect the negative battery cable from the battery terminal. (see Battery Removal).
- Disconnect the starter relay lead connector [A].
- Slide out the rubber caps [B].
- Remove the nuts [C] from the battery and starter terminals on the start relay switch.
- Remove the starter relay case bolts [D] and slide the starter relay switch from the relay case [E], being careful not to lose any of the insulating washers or grommets.

Starter Relay Installation



- Mount the starter relay switch [A] in the relay case [B].
- ○Coat the insulating washers [C] and grommets [D] with water resistant grease.
- ○Be certain all insulating washers and grommets are in position.
- ○Tighten the relay mounting nuts [E] securely.

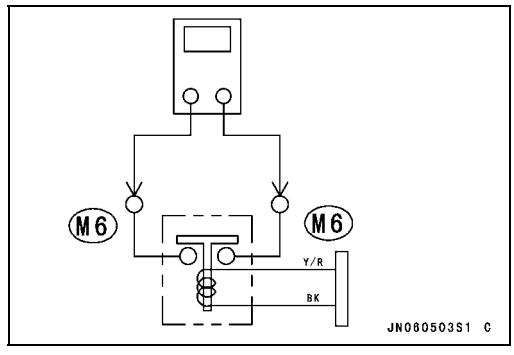
Torque - Starter Relay Mounting Nuts: 4 N·m (0.40 kgf·m, 35 in·lb)



- Replace the gasket [A] with a new one.
- Be sure the dowel pins [B] are in position.
- Be sure the grommet [C] is installed on the relay case [D].
- Be sure the battery cable is connected to the battery terminal having red mark.

Torque - Starter Relay Case Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)
Starter Cable Mounting Nuts: 4 N·m (0.40 kgf·m, 35 in·lb)

Starter Relay Inspection



- Remove the starter relay (see Starter Relay Removal).
- Set hand tester to R × 1 Ω range.
- Connect meter leads to starter relay as shown.

★If resistance is less than infinite, the starter relay switch is not returning and must be replaced.

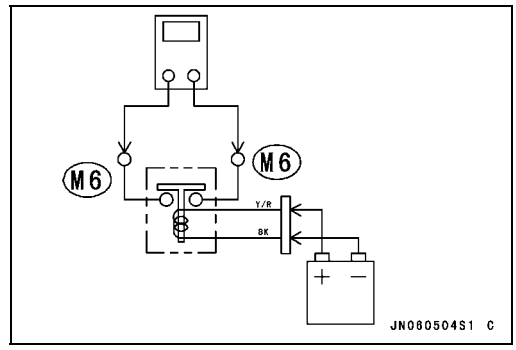
Special Tool - Hand Tester: 57001-1394

Electric Starter System

- Set ohmmeter to R × 1 Ω range.
- Connect meter leads to starter relay as shown.
- Activate starter relay switch by connecting a 12 V battery as shown.

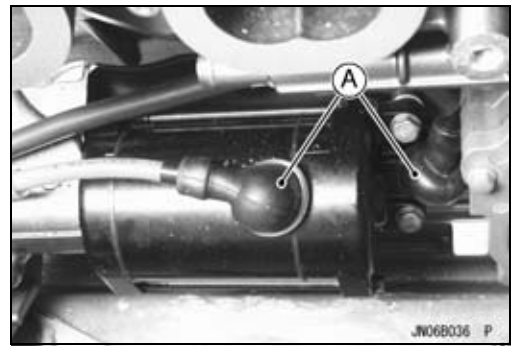
★If the starter relay switch clicks and the ohmmeter indicates zero resistance, the starter relay switch is good.

★If the meter indicates high or infinite (∞) resistance, the starter relay switch is defective and must be replaced.

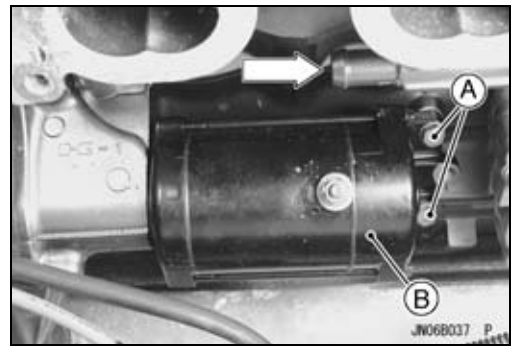


Starter Motor Removal

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Inlet Manifold (see Inlet Manifold Removal in the Fuel System chapter)
- Slide out the rubber caps [A] and remove the terminal nuts.



- Remove the mounting bolts [A].
- Pull out the starter motor [B].

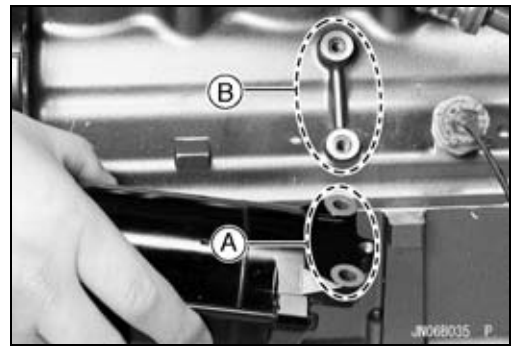


Starter Motor Installation

CAUTION

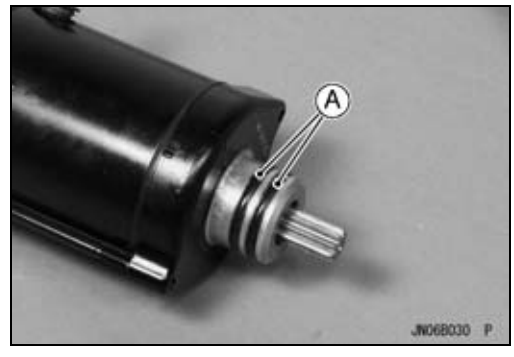
Do not tap the starter motor shaft or body. Tapping the shaft or body could damage the motor.

- When installing the starter motor, clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.



- Apply grease to the O-rings [A].
- Install the starter motor and tighten the mounting bolts.

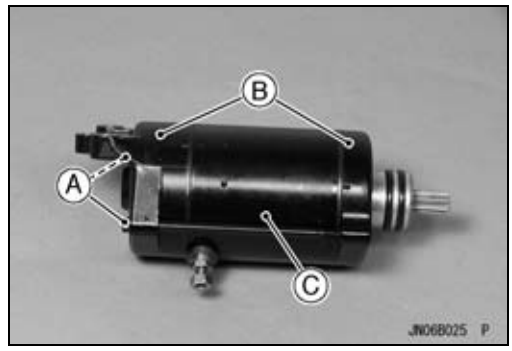
Torque - Starter Motor Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)



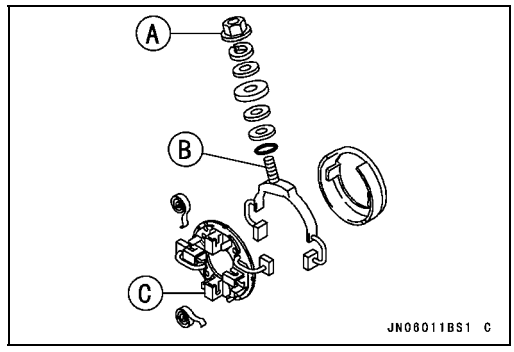
Electric Starter System

Starter Motor Disassembly

- Remove the starter motor (see Starter Motor Removal).
- Take off the starter motor through bolts [A] and remove both end covers [B] and pull the armature out of the yoke [C].

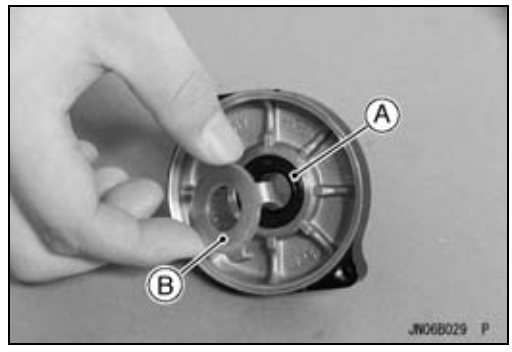


- Remove the terminal locknut [A] and terminal bolt [B], and then remove the brush with the brush plate [C] from the yoke.

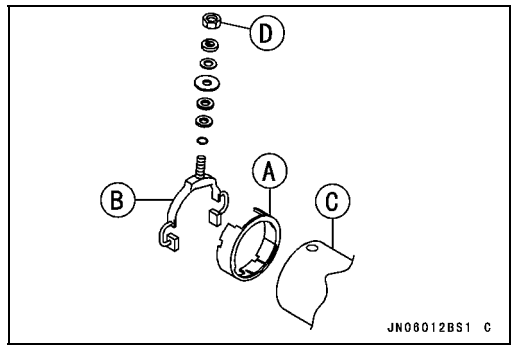


Starter Motor Assembly

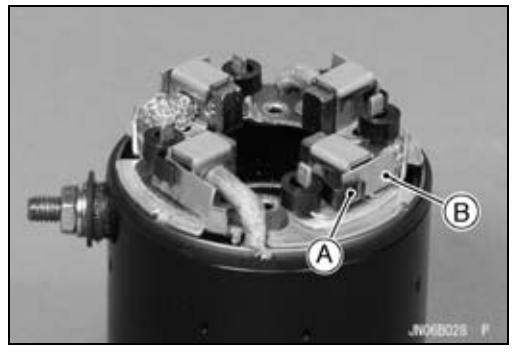
- Apply a thin coat of grease to the oil seal [A].
- Fit the toothed washer [B] into the end cover.



- Install the plate cover [A] and the positive brush assembly [B] in the yoke [C].
- Tighten the terminal nut [D] securely.

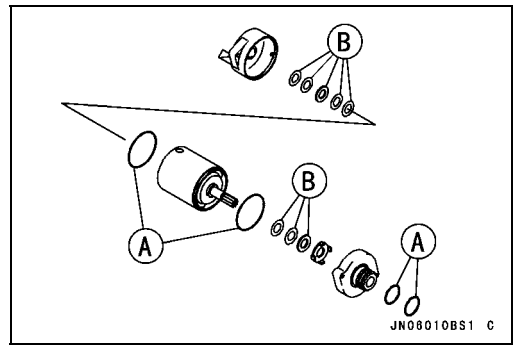


- Holding the spring ends [A] with suitable plates [B], put the armature among the brushes.

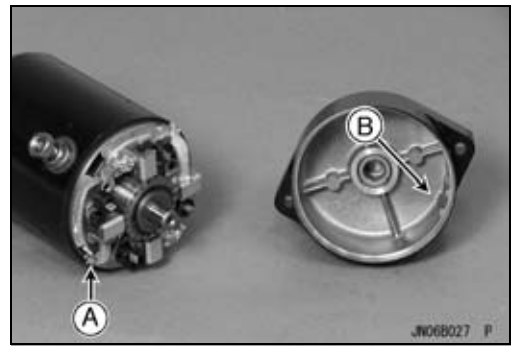


Electric Starter System

- Install the O-rings [A] and the washers [B] as shown.

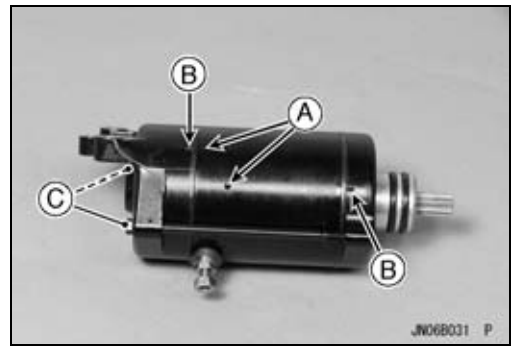


- Fit the tongue [A] on the brush plate into the end cover groove [B].



- Align the lines [A] on the yoke with the lines [B] on the both end covers.
- Replace the starter motor through bolts [C] with new ones.
- Tighten:

Torque - Starter Motor Through Bolts: 6.4 N·m (0.65 kgf·m, 56 in·lb)



Brush Inspection

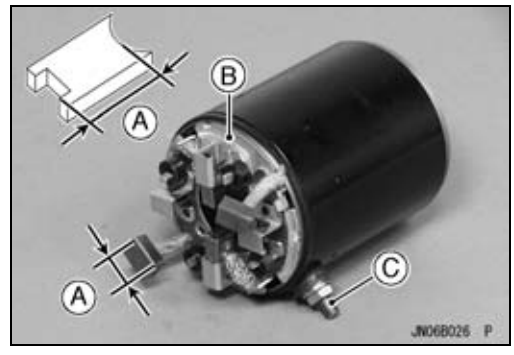
- Measure the length [A] of each brush.

★If any is worn down to the service limit, replace the negative brush assembly [B] and the positive brush assembly [C].

Starter Motor Brush Length

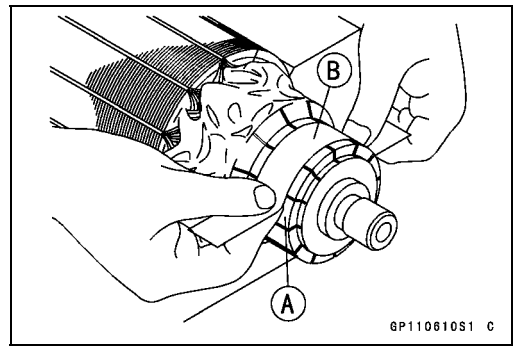
Standard: 12 mm (0.4724 in.)

Service Limit: 6.5 mm (0.2559 in.)



Commutator Cleaning and Inspection

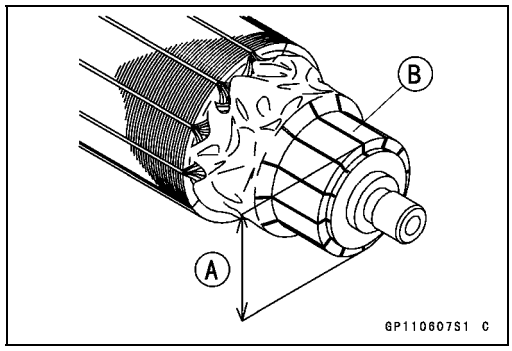
- Smooth the commutator surface [A] if necessary with fine emery cloth [B], and clean out the grooves.



Electric Starter System

● Measure the diameter [A] of the commutator [B].
★Replace the starter motor with a new one if the commutator diameter is less than the service limit.

Commutator Diameter
Standard: 28 mm (1.1024 in.)
Service Limit: 27 mm (1.063 in.)

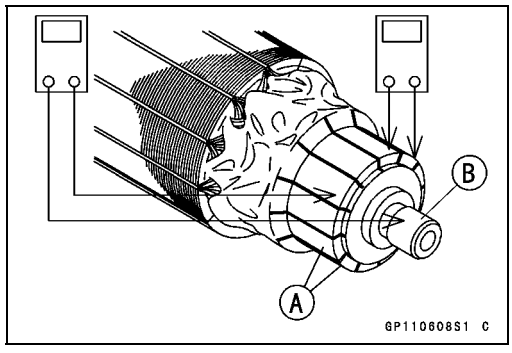


Armature Inspection

● Using the × 1 Ω hand tester range, measure the resistance between any two commutator segments [A].

Special Tool - Hand Tester: 57001-1394

★If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.
● Using the highest hand tester range, measure the resistance between the segments and the shaft [B].
★If there is any reading at all, the armature has a short and the starter motor must be replaced.



NOTE

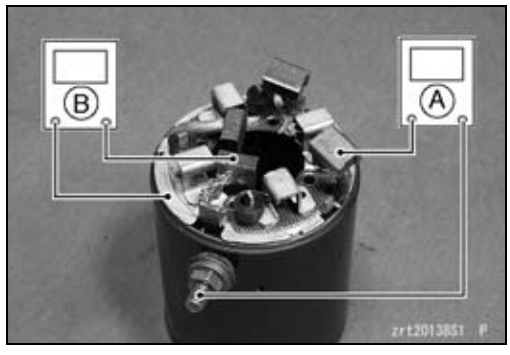
○*Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable within the hand tester. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.*

Brush Lead Inspection

● Using the × 1 Ω hand tester range, measure the resistance as shown.
[A] Terminal and Positive Brush
[B] Brush Plate and Negative Brush

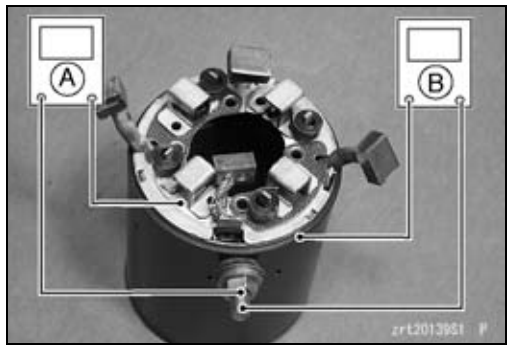
Special Tool - Hand Tester: 57001-1394

★If there is not close to zero ohms, the brush lead has an open. Replace the positive brush assembly and/or the negative brush assembly.



Brush Plate and Terminal Bolt Inspection

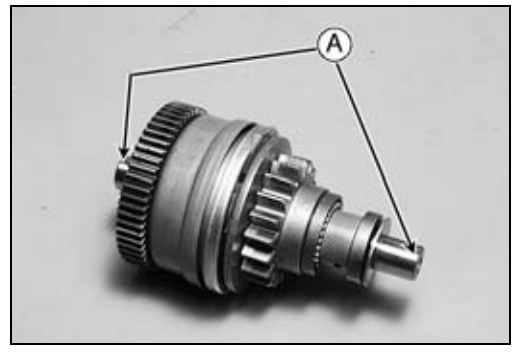
● Using the highest hand tester range, measure the resistance as shown.
[A] Terminal Bolt and Brush Plate
[B] Terminal Bolt and Yoke
★If there is any reading, the negative brush assembly and/or positive brush assembly have a short. Replace the negative and positive brush assemblies.



Electric Starter System

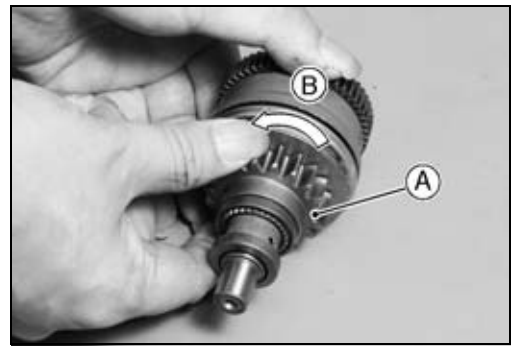
Reduction Gear Removal/Installation

- Before removing the reduction gear, remove the magneto flywheel (see Magneto Flywheel Removal in the Engine Bottom End chapter).
- When installing the reduction gear, apply a molybdenum disulfide grease [A] to both ends of its shaft.



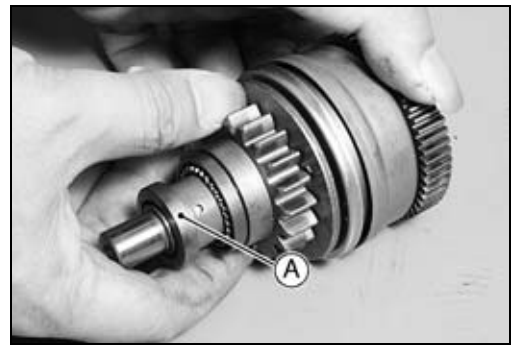
Reduction Gear Inspection

- Rotate the pinion gear [A] counterclockwise. The gear must be rotated freely [B].



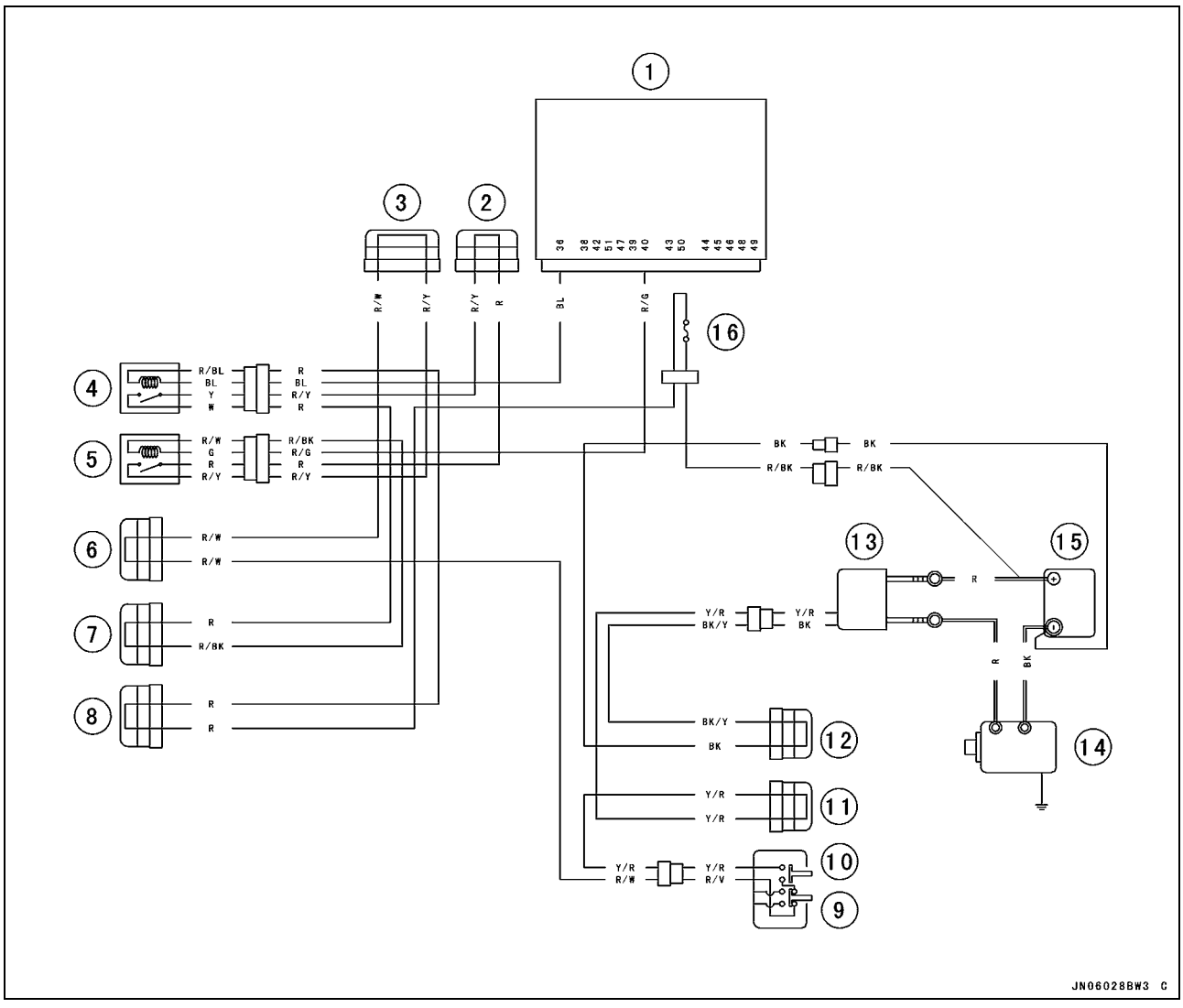
- Rotate the pinion gear clockwise all the way. The pinion gear will be advanced along the reduction gear shaft, and stopped against the stopper [A].
- Release the pinion gear. The pinion gear must return to the initial position rapidly.

★If the pinion gear does not function properly, replace it.



Electric Starter System

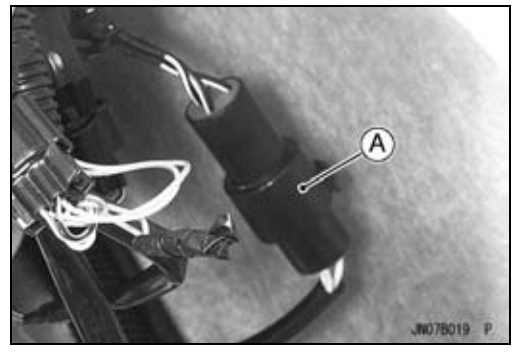
Electric Starter Circuit



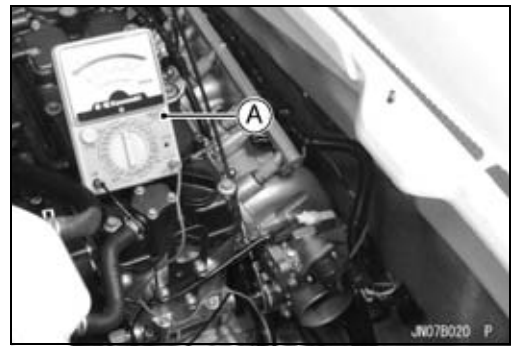
1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 3 (Switch (12V))
7. Joint Connector 2
8. Joint Connector 1
9. Engine Stop Switch/Tether
10. Engine Start Switch
11. Joint Connector 13
12. Joint Connector 12 (Ground)
13. Starter Relay
14. Starter Motor
15. Battery
16. Main Fuse 20A

Charging System

Magneto Output Voltage



- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Air Filter with Duct (see Air Filter Removal in the Fuel System chapter)
- Disconnect the 3-pin stator coil leads connector [A].



- With the hand tester [A] check the magneto output (in circuit) according to the following table with the engine running at approximately 3 000 rpm.

⚠ WARNING

To avoid electrical shock, do not perform this test with the watercraft in the water.

CAUTION

Do not run the engine over 15 seconds without cooling water.

Magneto Output Voltage

Meter Setting	Connections		Standard Value
	Meter (+) to	Meter (–) to	
250 V AC	White lead	White lead	48 ~ 72 V

★If the magneto output voltage is correct, check the regulator according to the regulator test procedure.

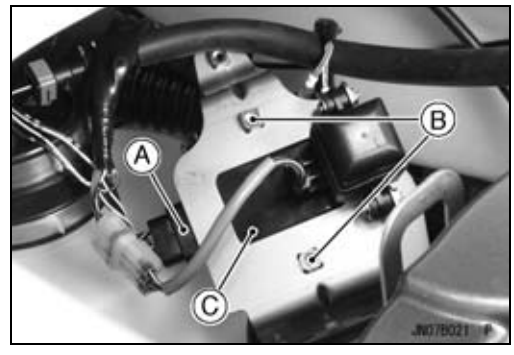
★If the magneto output voltage is low, check the stator coil resistance with a multimeter according to the following table.

Stator Coil Resistance Test

Meter Setting	Connections		Standard Value
	Meter (+) to	Meter (–) to	
R × 1 Ω	White lead	White lead	0.432 ~ 0.648 Ω

★If the coil has normal resistance, but the voltage check shows the charging system to be defective, then the permanent magnets in the flywheel have probably weakened, necessitation flywheel replacement.

Regulator/Rectifier Removal/Installation



- Remove the seat (see Hull/Engine Hood chapter).
- Disconnect the connector [A].
- Unscrew the mounting bolts [B] and remove the regulator/rectifier [C].

● Tighten:

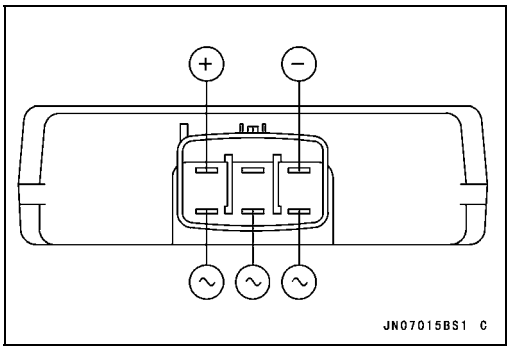
Torque - Regulator/rectifier Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

● When installing the bracket, apply a non-permanent locking agent to the bracket mounting screws and tighten them securely.

Regulator/Rectifier Inspection

● With the hand tester set to the R × 1 kΩ range, test the regulator/rectifier according the following table.

Special Tool - Hand Tester: 57001-1394



Regulator/Rectifier Inspection **Unit: kΩ**

	Tester (+) Lead Connection					
(–)*	Terminal	+	~	~	~	–
	+	–	500 ~ ∞	500 ~ ∞	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	–	500 ~ ∞	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	500 ~ ∞	–	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	500 ~ ∞	500 ~ ∞	–	500 ~ ∞
	–	2 ~ 40	2 ~ 20	2 ~ 20	2 ~ 20	–

(–)*: Tester (–) lead Connection

★If any of the values obtained does not match with the above table, the regulator/rectifier must be replaced.

Regulator Inspection

○To test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ~6 W bulb in a socket with leads).

CAUTION

The test light works as an indicator and also as a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.

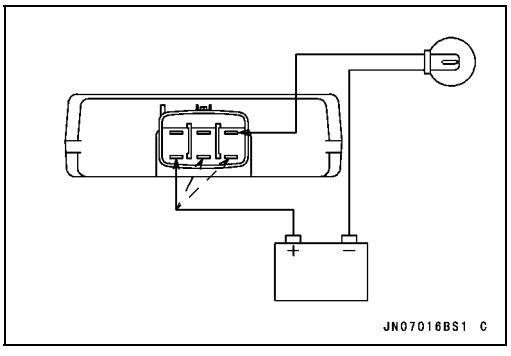
● Do the 1st step regulator circuit test.

○Connect the test light and the 12 V battery to the regulator/rectifier as shown.

○Check infinity (~) terminals respectively.

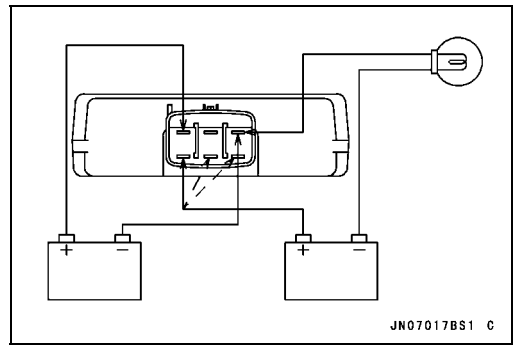
★If the test light turns on, the regulator/rectifier is defective. Replace it.

★If the test light does not turn on, continue the test.



Charging System

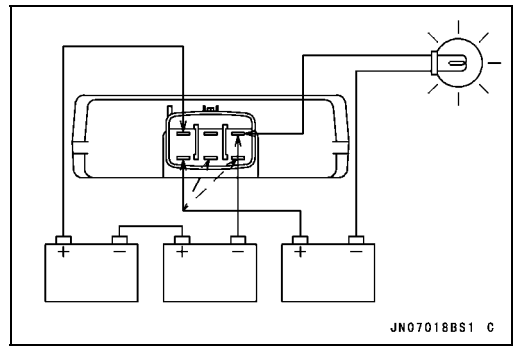
● Do the 2nd step regulator circuit test.
○Connect the test light and the 12 V battery in the same manner as specified in the “1st step regulator circuit test”.
○Apply 12 V to the positive (+) terminal.
○Check infinity (~) terminals respectively.
★If the test light turns on, the regulator/rectifier is defective. Replace it.
○If the test light does not turn on, continue the test.



● Do the 3rd step regulator circuit test.
○Connect the test light and the 12 V battery in the same manner as specified in the “1st step regulator circuit test”.
○Momentarily apply 24 V to the positive (+) terminal by adding a 12 V battery.
○Check infinity (~) terminals respectively.

CAUTION

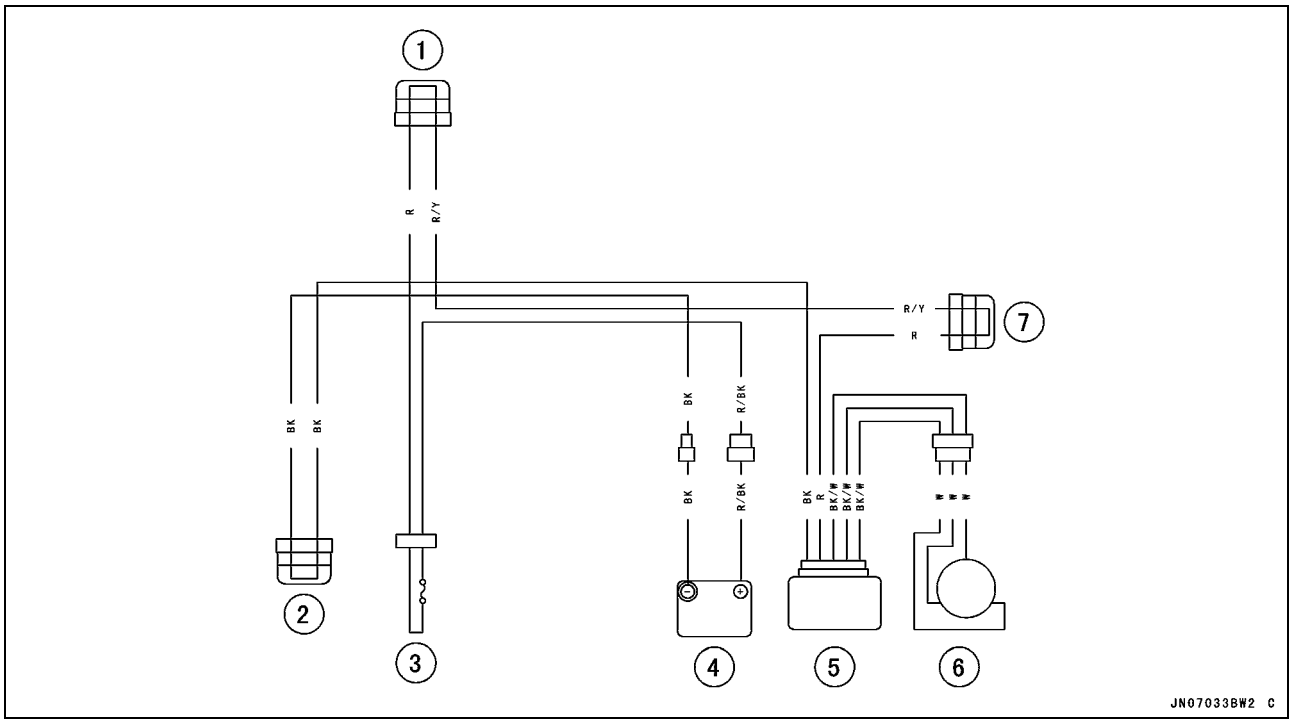
Do not apply more than 24 volts. If more than 24 volts is applied, the regulator/rectifier may be damaged. Do not apply 24 V more than a few seconds. If 24 volts is applied for more than a few seconds, the regulator/rectifier may be damaged.



★If the test light does not light when 24 V is applied momentarily to the positive (+) terminal, the regulator/rectifier is defective. Replace it.
★If the regulator/rectifier passes all the tests described, it may still be defective. If the charging system still does not work properly after checking all the components and the battery, test the regulator/rectifier by replacing it with a known good unit.
● Repeat the test for another regulator/rectifier.

Charging System

Charging System Circuit



1. Joint Connector 1
2. Joint Connector 12 (Ground)
3. Main Fuse 20 A
4. Battery
5. Regulator/Rectifier
6. Magneto
7. Joint Connector 8 (Vcc)

Ignition System

⚠ WARNING

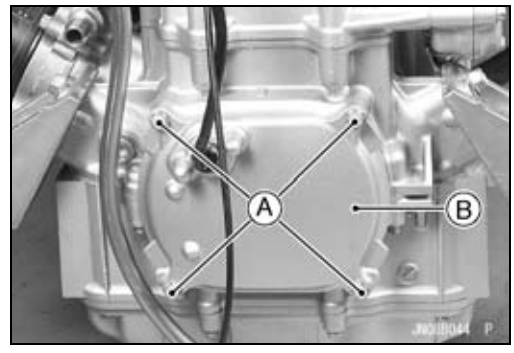
The ignition system produces extremely high voltage. Do not touch the spark plugs, ignition coils, or spark plug leads while the engine is running, or you could receive a severe electrical shock.

CAUTION

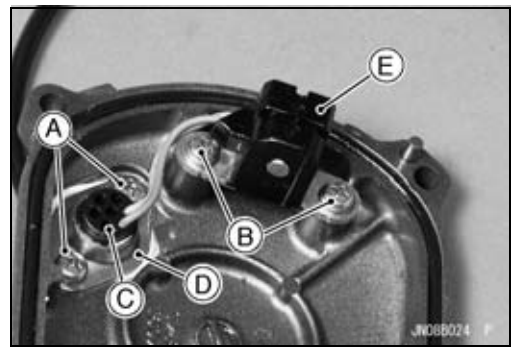
Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent ECU (Electronic Control Unit) damage.
Do not install the battery backwards. The negative side is grounded. This is to prevent damage to the diodes and ECU.

Crankshaft Sensor Removal

- Remove:
  Engine (see Engine Removal in the Engine Removal/Installation chapter)
  Crankshaft Sensor Cover Bolts [A]
  Crankshaft Cover [B]



- Unscrew:
  Rubber Grommet Holder Screws [A]
  Crankshaft Sensor Screws [B]
- Push out the rubber grommet [C] with the Holder [D].
- Remove the crankshaft sensor [E].



Crankshaft Sensor Installation

- Run the sensor lead through the cover hole.
- Install the crankshaft sensor [A].

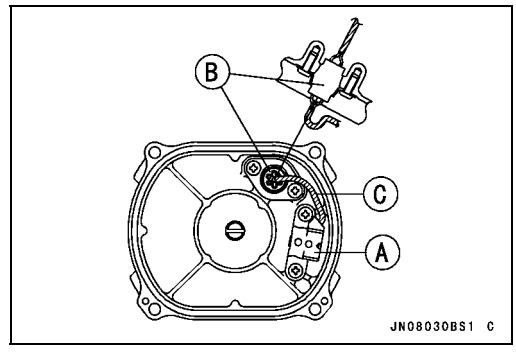
○Apply a non-permanent locking agent to the sensor screws.

Torque - Crankshaft Sensor Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)

- Install the rubber grommet [B] in the sensor cover hole.

○Apply water resistant grease to the grommet outside.
○Apply a non-permanent locking agent to the grommet holder screws.
○Run the sensor lead [C] as shown.

Torque - Rubber Grommet Holder Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)



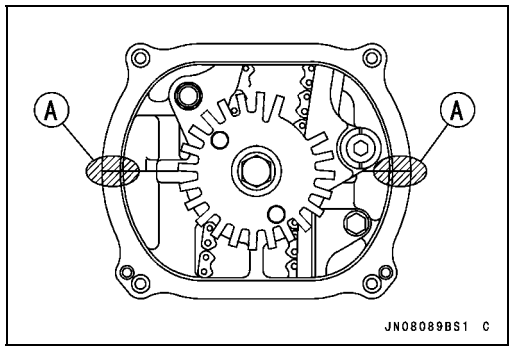
- Apply grease to the O-ring and fit it in the groove of the sensor cover.
- Apply silicone sealant [A] to the crankcase halves mating surface on the right and left sides of the crankshaft sensor mount.

Sealant - Kawasaki Bond (Silicone Sealant): 56019-120

- Install the crankshaft sensor cover.

Torque - Crankshaft Sensor Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install the Engine (see Engine Removal/Installation chapter).

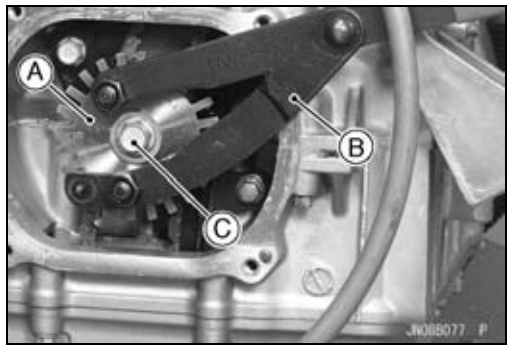


Timing Rotor Removal

- Remove the engine (see Engine Removal in the Engine Removal/Installation chapter).
- Remove the crankshaft sensor cover (see Crankshaft Sensor Removal).
- Remove the timing rotor [A].

○Holding the timing rotor with the flywheel and pulley holder [B] and unscrew the bolt [C].

Special Tools - Flywheel & Pulley Holder: 57001-1605
Flywheel and Pulley Holder Adapter: 57001 -1547 [D]



Timing Rotor Installation

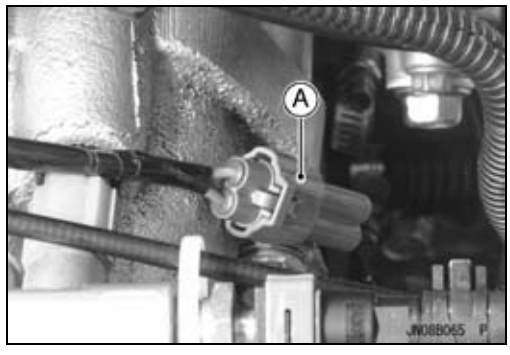
- Fit the rotor to the crankshaft.
- Apply a non-permanent locking agent to the rotor bolt.
- Tighten the rotor bolt.

Torque - Timing Rotor Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Install the crankshaft sensor cover (see Crankshaft Sensor Cover Installation).

Crankshaft Sensor Inspection

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
- Disconnect the 2-pin crankshaft sensor leads connector (Blue) [A].



- Set the hand tester to the × 100 Ω range, zero it, and connect it to the crankshaft sensor lead terminals (G and BL) in the connector.

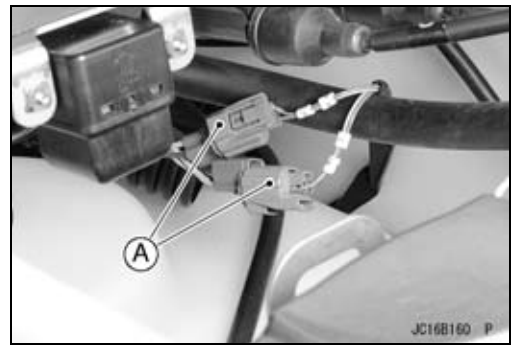
★If there is more resistance than the specified value, the sensor has an open lead and must be replaced. Much less than this resistance means the sensor is shorted, and must be replaced.

Crankshaft Sensor Resistance
Standard: 408 ~ 612 Ω

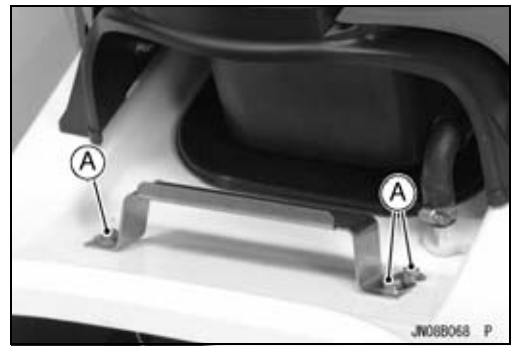
Ignition System

Ignition Coil Removal

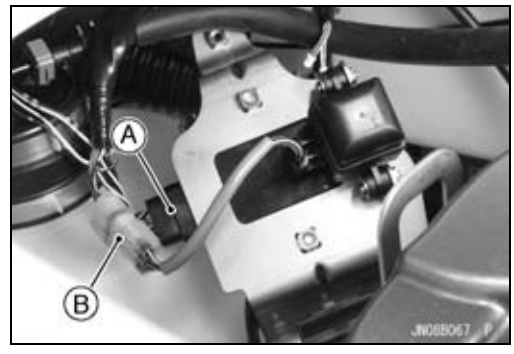
- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
- Disconnect the ignition coil primary lead connectors [A].



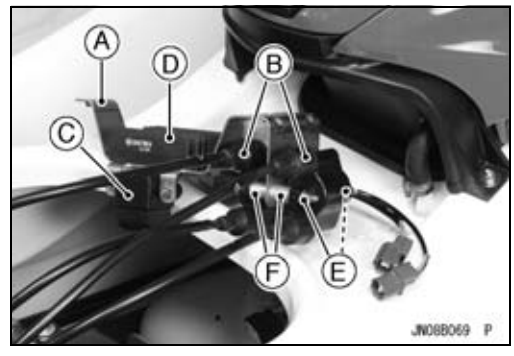
- Remove the bracket bolts [A].



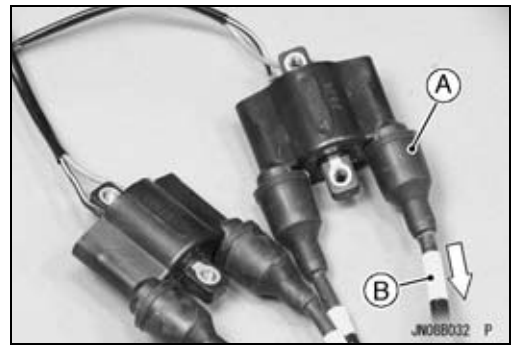
- Disconnect the regulator/rectifier lead connector [A] and vehicle-down sensor lead connector [B].



- Pull up the bracket [A] together with the ignition coils [B], vehicle-down sensor [C], and regulator/rectifier [D] installed.
- Unscrew the nuts [E] and remove the bolts, collars [F] and ignition coils.



- Pull out the spark plug lead [B] from the ignition coil [A]. Lubricate the leads with penetrating rust inhibitor.



Ignition System

Ignition Coil Installation

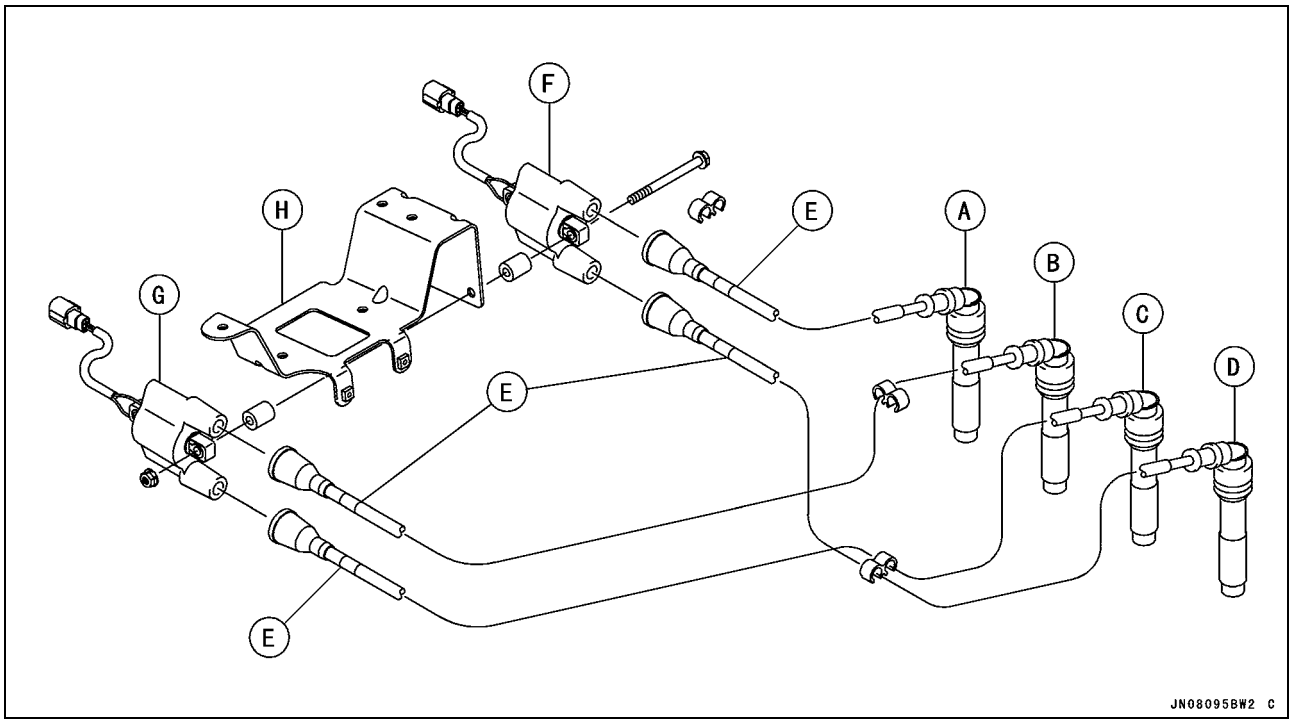
- Connect the spark plug lead to each ignition coil as follows.
  #1 Spark Plug Lead Length 340 mm (13.4 in.) [A]
  #2 Spark Plug Lead Length 450 mm (17.7 in.) [B]
  #3 Spark Plug Lead Length 540 mm (21.3 in.) [C]
  #4 Spark Plug Lead Length 600 mm (23.6 in.) [D]

○Marked [E] is a number of each lead

- Apply a non-permanent locking agent to the ignition coil mounting bolts.
- Install the #1, 4 ignition coil [F] and #2, 3 ignition coil [G] to the bracket [H].

Torque - Ignition Coil Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

○Apply a non-permanent locking agent to the bracket bolts.



- Install the removal parts.

Ignition System

Ignition Coil Inspection

Measuring arcing distance

The most accurate test for determining the condition of the ignition coil is made by measuring arcing distance.

- Remove the ignition coil (see Ignition Coil Removal).
- Connect the ignition coil [A] (with the spark plug cap left installed on the spark plug lead) to the tester [B], and measure the arcing distance.

Auxiliary Wires [C]

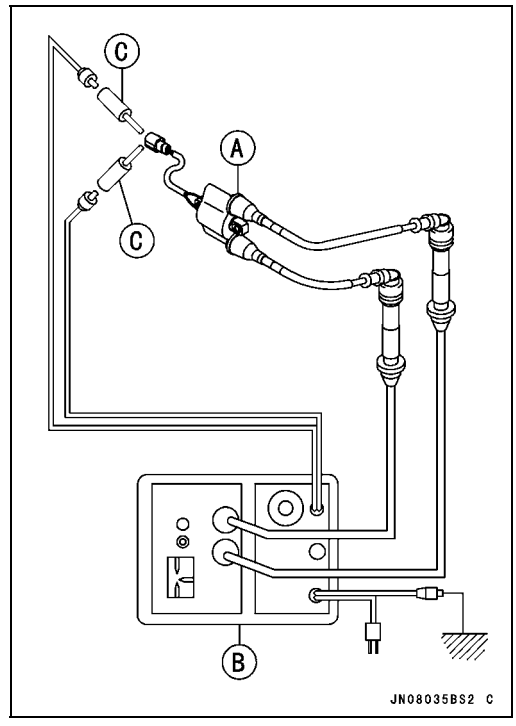
⚠ WARNING

To avoid extremely high voltage shocks, do not touch the coil or lead.

★If the distance reading is less than the specified value, the ignition coil or spark plug cap is defective.

3 Needle Arcing Distance

Standard: 7 mm (0.28 in.) or more



- To determine which part is defective, measure the arcing distance again with the spark plug leads removed from the ignition coil (see Ignition Coil Removal).

★If the arcing distance is subnormal as before, the trouble is with the ignition coil itself. If the arcing distance is now normal, the trouble is with the spark plug lead.

Measuring coil resistance

If the Coil Tester is not available, the coil can be checked for a broken or badly shorted winding with a hand tester. However, a hand tester can not detect layer shorts and shorts resulting from insulation breakdown under high voltage.

- Disconnect the primary leads from the coil terminals.
- Measure the primary winding resistance as follows [A].

○Connect the tester between the coil terminals.

○Set the tester to the × 1 Ω range, and read the tester.

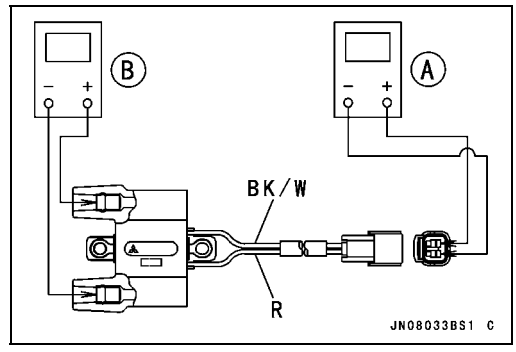
- Measure the secondary winding resistance as follows [B].

○Remove the spark plug leads (see Ignition Coil Removal).

○Connect the tester between the secondary lead terminals.

○Set the tester to the × 1 kΩ, and read the tester.

★If the hand tester does not read as specified, replace the coil.



Winding Resistance

Standard: Primary windings 1.53 ~ 2.07 Ω

Secondary windings 12.50 ~ 16.91 kΩ

★If the tester reads are as specified, the ignition coil windings are probably good. However, if the ignition system still does not perform as it should after all other components have been checked, test replace the coil with one known to be good.

Ignition System

Measuring spark plug lead resistance

- Check the spark plug lead [A] for visible damage.

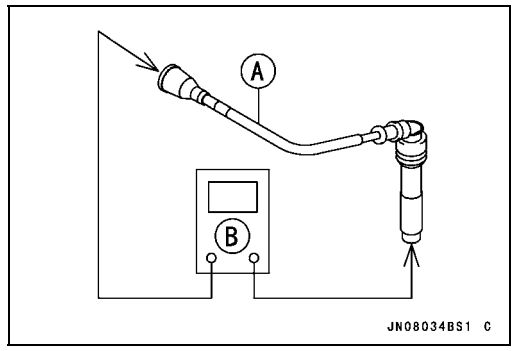
★If the spark plug lead is damaged, replace the spark plug lead.

- Measure the lead resistance with the hand tester [B].

Spark Plug Lead Resistance
Standard:

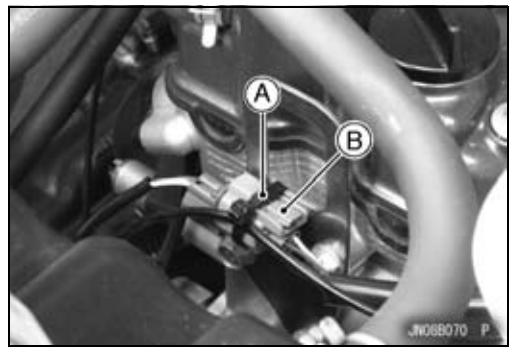
JT1500B7F:	**3.75 ~ 6.25 kΩ**
JT1500B8F:	**2.80 ~ 4.79 kΩ**

★If the hand tester does not read as specified, replace the lead

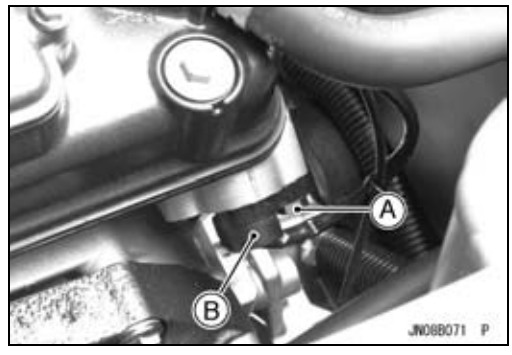


Camshaft Position Sensor Removal

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
- Cut off the clamp [A].
- Disconnect the camshaft position sensor lead connector [B].



- Remove:
  Camshaft Position Sensor Bolt [A]
  Camshaft Position Sensor [B]



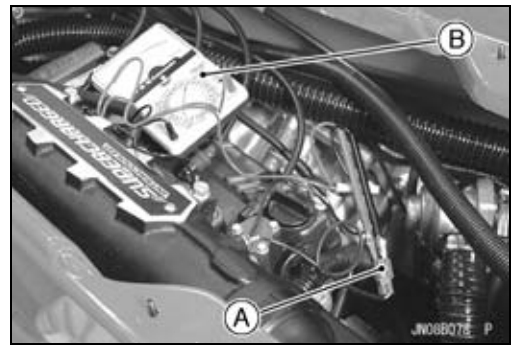
Camshaft Position Sensor Installation

- Apply grease or engine oil to the O-ring on the camshaft position sensor.
- Tighten:

Torque - Camshaft Position Sensor Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Ignition System

Camshaft Position Sensor Inspection



- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)
  Camshaft Position Sensor Lead Connector [A] (disconnect)
- Set the hand tester [B] to the × 10 Ω range and connect it to the yellow and black leads in the connector.

Special Tool - Hand Tester: 57001-1394

★If there is more resistance than the specified value, the sensor coil has an open lead and must be replaced. Much less than this resistance means the sensor coil is shorted, and must be replaced.

Camshaft Position Sensor Resistance: 400 ~ 460 Ω

- Using the highest resistance range of the tester, measure the resistance between the camshaft position sensor leads and chassis ground.

★Any tester reading less than infinity (∞) indicates a short, necessitating replacement of the camshaft position sensor.

Igniter Removal/Installation

- Refer to ECU Removal in the Fuel System (DFI) chapter.

Igniter Inspection

○The igniter is built in the ECU (Electronic Control Unit).

CAUTION

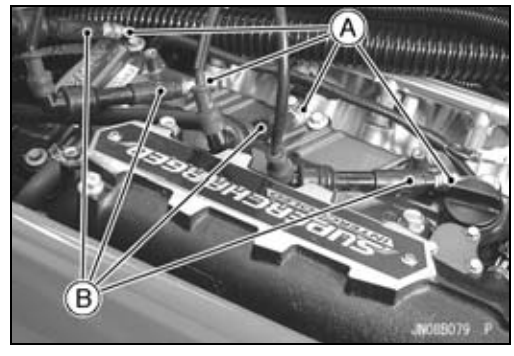
Do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running. This is to prevent igniter in the ECU damage.

Ignition Coil Primary Peak Voltage Check

NOTE

○*Be sure the battery is fully charged.*

- Remove:
  Seat (see Seat Removal in the Hull/Engine Hood chapter)



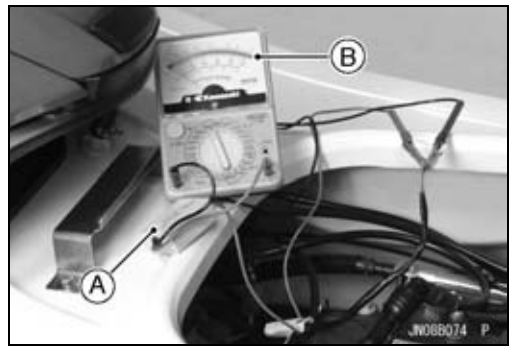
- Pull all the spark plug caps from the spark plugs.
- Install the new spark plugs [A] into each plug caps [B], and ground them onto the engine.

NOTE

○*Maintain the correct value of compression pressure for the cylinder (Be sure to measure the voltage with the spark plug installed to the cylinder head).*

Ignition System

● Remove:
Front Storage Pocket (see Hull/Engine Hood chapter)
● Install the peak voltage adapter [A] into the hand tester [B].



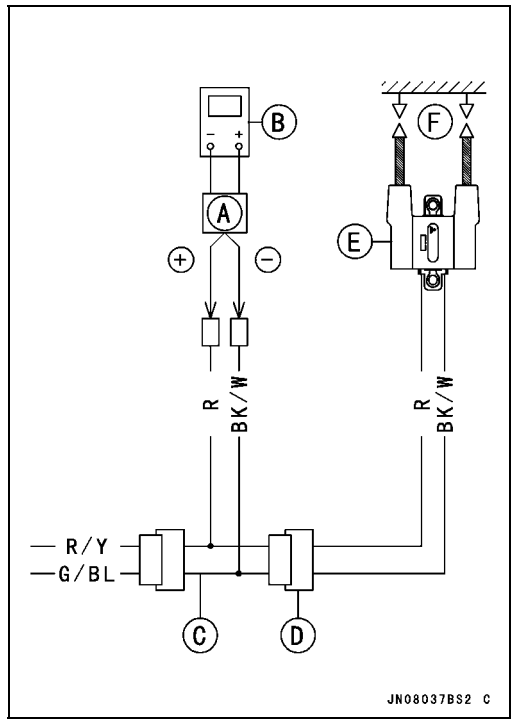
● Connect the peak voltage adapter [A] to the ignition coil primary lead connector [D], using the harness adapter [C].
Hand Tester [B]
Ignition Coil [E]
Spark Plugs [F]

Special Tools - Hand Tester: 57001-1394
Harness Adapter: 57001-1562
Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

Hand Tester Range: × DC 1 000 V

Primary Lead Connections

	Adapter (R, +)		Adapter (BK, –)
#1, 4 Ignition Coil:	**R**	←→	**BK/W (Ground)**
#2, 3 Ignition Coil:	**R**	←→	**BK/W (Ground)**



⚠ WARNING

To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.

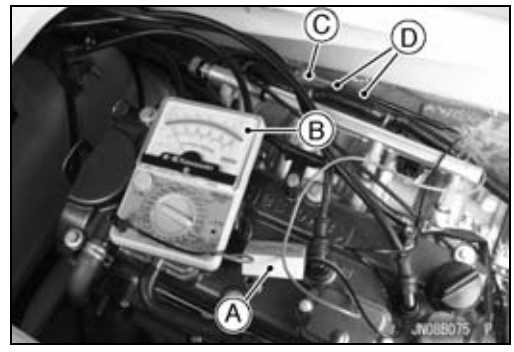
● Turn the ignition switch on and push the lanyard key under the stop button.
● Pushing the starter button, crank the engine 4 ~ 5 seconds to measure the primary peak voltage.
○Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.
● Repeat the measurements 5 or more times for one ignition coil.

Ignition Coil Primary Peak Voltage
Standard: 250 V or more

● Repeat the test for the other ignition coil.
★If the reading is less than the specified value, see “Ignition System Troubleshooting” table to determine whether igniter is good or no good.

Ignition System

Crankshaft Sensor Peak Voltage Check



NOTE

○*Be sure the battery is fully charged.*

- Connect the peak voltage adapter [A] to the hand tester [B].

Special Tool - Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

- Connect the adapter the crankshaft sensor lead connector [C], using the needle adapter set [D].

Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457

Connections

	Adapter (R, +)		Adapter (BK, –)
Crankshaft Sensor:	**G**	←→	**BL**

Hand Tester Range: × DC 10 V

- Turn the ignition switch on and push the lanyard key under the stop button.
- Pushing the starter button, crank the engine 4 ~ 5 seconds to measure the crankshaft sensor peak voltage.

○Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.

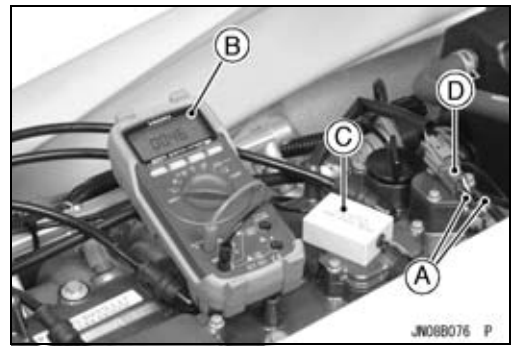
- Repeat the measurements 5 or more times.

Crankshaft Sensor Peak Voltage
Standard: 2.5 V or more

★If the reading is less than the specified value, check the crankshaft sensor (see Crankshaft Sensor Inspection).

Camshaft Position Sensor Peak Voltage Inspection

- Remove:
  Seat (see Hull/Engine Hood chapter)



- Set the digital meter [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the digital meter.

Special Tool - Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

- Connect the peak voltage adapter to the camshaft sensor lead connector [D], using the needle adapter set [A].

Special Tool - Needle Adapter Set: 57001-1457

Connections

Camshaft Sensor Lead		Adapter		Hand Tester
Black	←	**Red**	→	**(+)**
Yellow	←	**Black**	→	**(−)**

- Turn the ignition switch and engine stop switch on.
- Pushing the starter button, turn the engine 4 ~ 5 seconds to measure the camshaft position sensor peak voltage.
- Repeat the measurement 5 or more times.

Camshaft Position Sensor Peak Voltage
Standard: 0.4 V or more

★If the peak voltage is lower than the standard, inspect the camshaft position sensor.

Ignition System

Spark Plug Removal

- Refer to Spark Plug Inspection in the Periodic Maintenance chapter.

Spark Plug Installation

- Refer to Spark Plug Inspection in the Periodic Maintenance chapter.

Spark Plug Inspection

- Refer to Spark Plug Inspection in the Periodic Maintenance chapter.

Spark Plug Adjustment

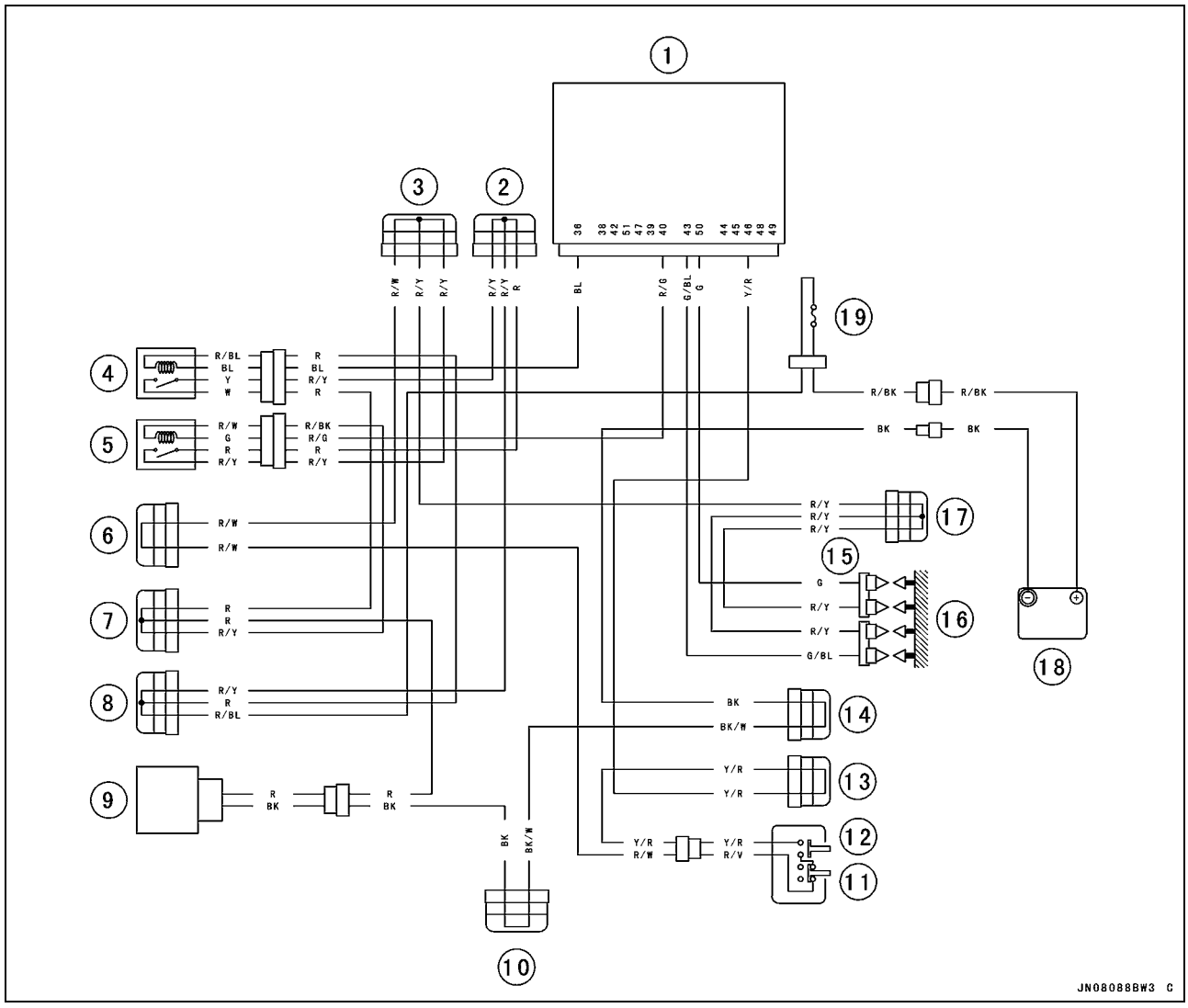
- Refer to Spark Plug Adjustment in the Periodic Maintenance chapter.

Spark Plug Cleaning

- Refer to Spark Plug Cleaning in the Periodic Maintenance chapter.

Ignition System

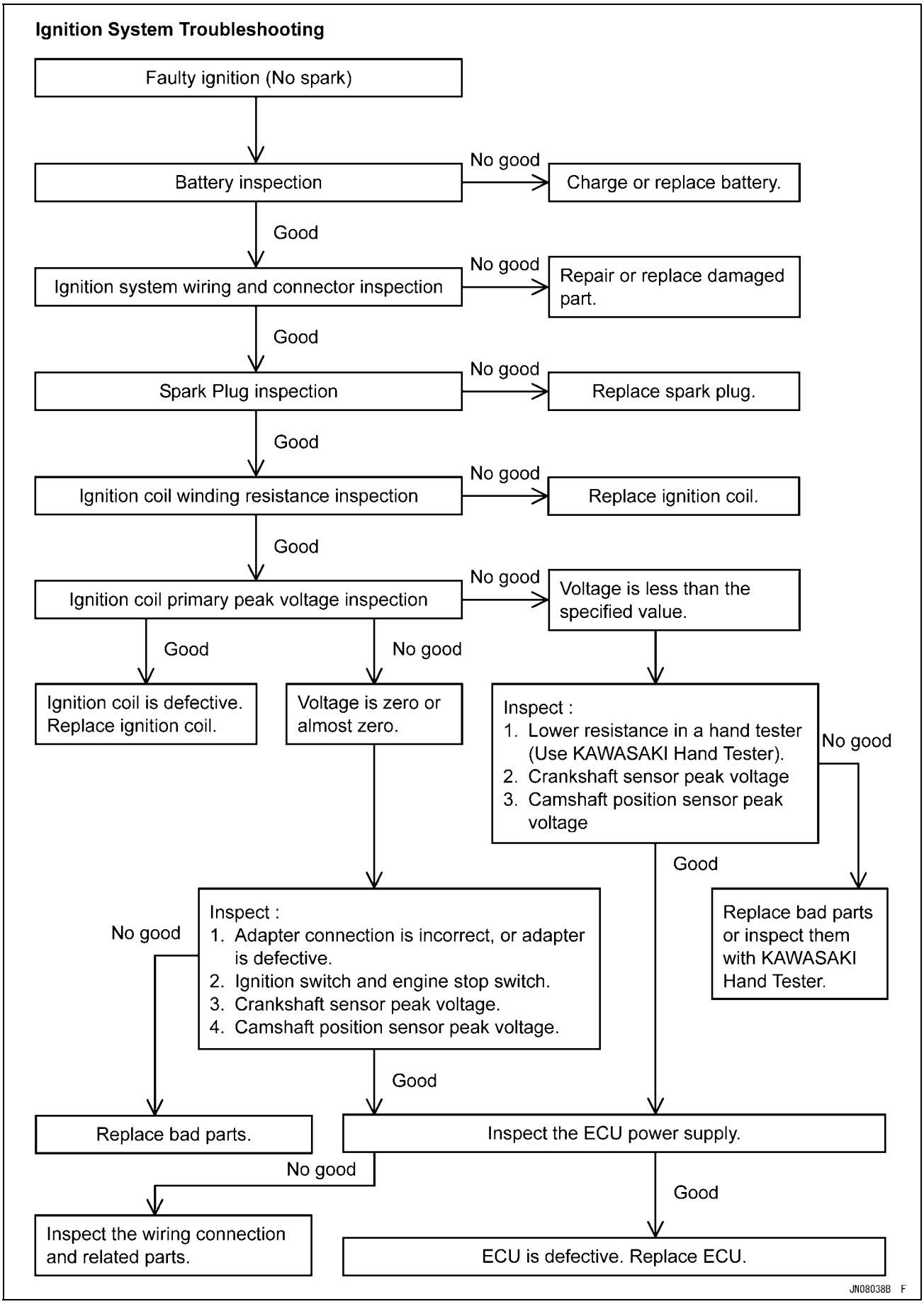
Ignition System Circuit



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 3 (Switch (12 V))
7. Joint Connector 2
8. Joint Connector 1
9. Ignition Switch (Immobilizer Amplifier)
10. Joint Connector 15 (Ground)
11. Engine Stop Switch/Tether
12. Engine Start Switch
13. Joint Connector 13
14. Joint Connector 12 (Ground)
15. Ignition Coils
16. Spark Plugs
17. Joint Connector 10 (Ignition Coil (12 V))
18. Battery
19. Main Fuse 20 A

Ignition System

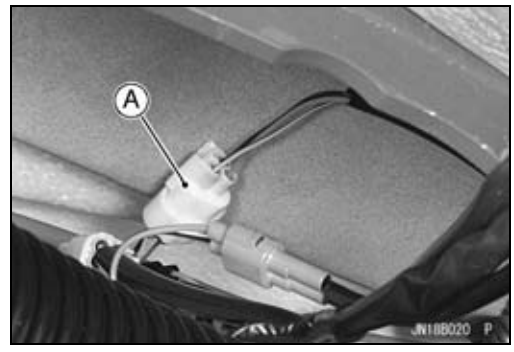
Ignition System Troubleshooting

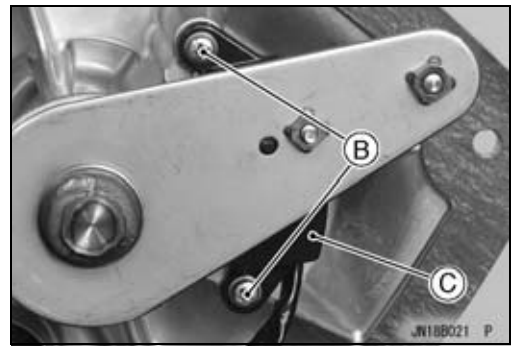


Kawasaki Smart Steering System

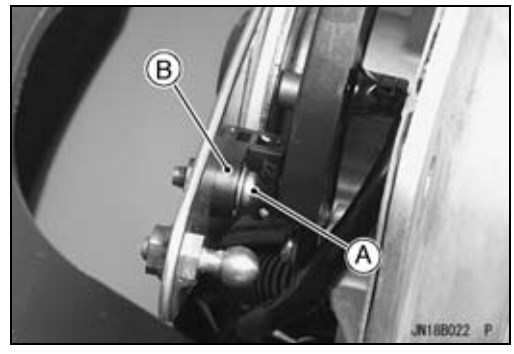
Steering Position Sensor and Magnet Removal

- Remove the steering holder (see Steering Removal in Steering chapter).
- Remove or disconnect:
  Steering Position Sensor Lead Connector [A]
  Leads Clamp on Steering Holder
  Steering Position Sensor Mounting Screws [B]
  Steering Position Sensor [C]





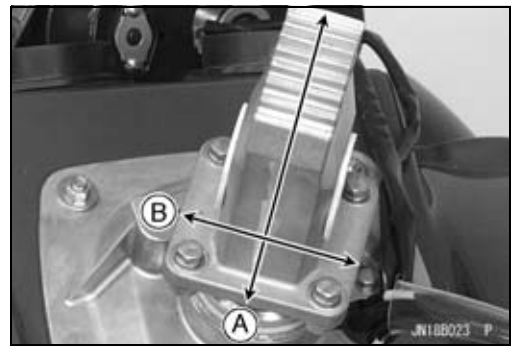
- Unscrew the mounting screw [A] and remove the magnet [B].



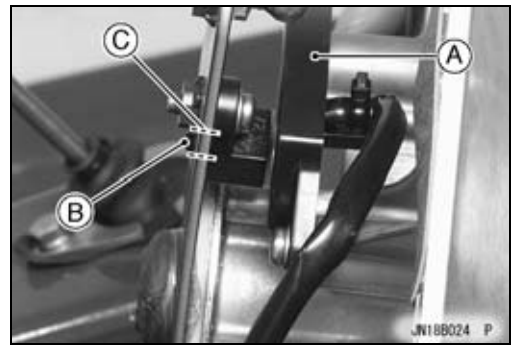
Steering Position Sensor and Magnet Installation

- Moving the steering shaft in the direction [A] and [B], check the steering shaft for excessive play.

★If necessary, adjust the steering shaft nut or replace the bushings.



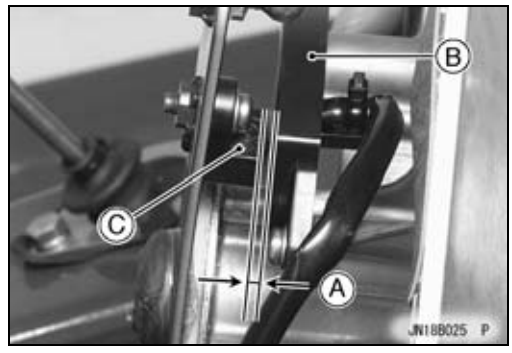
- Apply a non-permanent locking agent to the steering position sensor mounting screws and magnet mounting screw.
- Install the steering position sensor [A] to the steering holder and align the projection [B] on the magnet with the hole [C] on the steering shaft plate.



- Turning the steering shaft fully in left and right direction, check whether the steering position sensor comes in contact with the magnet.
- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance
Standard: 0.5 ~ 1.5 mm (0.02 ~ 0.06 in.)

★If necessary, adjust the steering shaft nut.
- Check the operation of Kawasaki Smart Steering system.



Inspection of Kawasaki Smart Steering System

- Inspect the smart steering system with the watercraft in the water.
- Center the handlebar in the straight-ahead position .
- Squeeze the throttle lever and allow it to approx. 4 000 rpm or above for 4 seconds or more.
- Release the throttle lever.
- Within 1 second, turn the handlebar all the way to the left or right and check the engine speed increases to approx. 3 300 rpm, and then decreases to approx. 2 600 rpm.
- Center the handlebar in the straight-ahead position, and check the engine speed decreases to an idle speed.

★If the Kawasaki Smart Steering system does not operate normally, check the steering position sensor clearance.

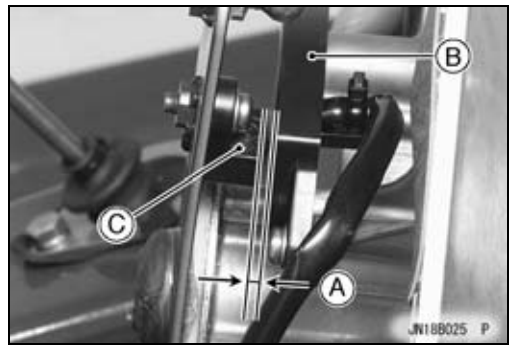
Steering Position Sensor Clearance

- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance
Standard: 0.5 ~1.5 mm (0.02 ~ 0.06 in.)

★If the clearance is the specified value, inspect steering position sensor input voltage.

★If necessary, adjust the steering shaft nut.



Kawasaki Smart Steering System

Steering Position Sensor Input Voltage Inspection

● Measure the input voltage to the steering position sensor.

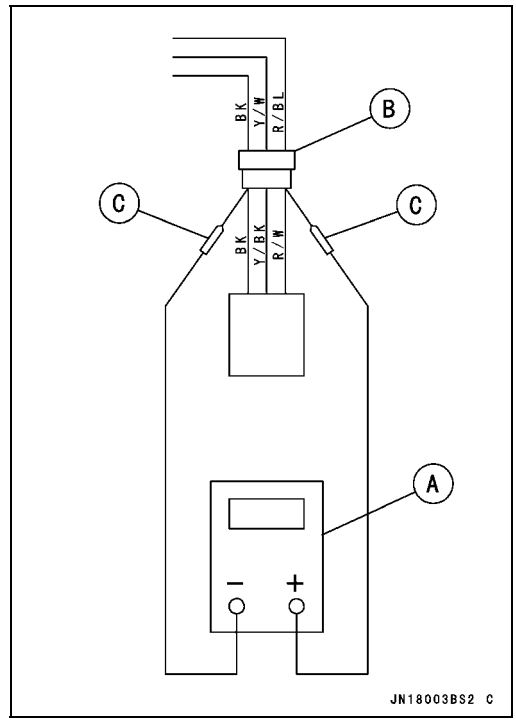
NOTE

○*Be sure the battery is fully charged.*

○Connect a digital voltmeter [A] to the lead connector [B] of the steering position sensor using the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Connections to Steering Position Sensor Connector
Meter (+) → R/W Terminal
Meter (–) → BK Terminal



○Turn the ignition switch ON.
○Center the handlebar in the straight-ahead position.
○Measure the input voltage.

Steering Position Sensor Input Voltage
Standard: Battery Voltage

○Turn the ignition switch OFF.
★If the reading is good, inspect steering position sensor output voltage.
★If the reading is out of the standard, check the following.
Battery Voltage
20 A Main Fuse
Power Source Wiring (see Steering Position Sensor Circuit)

Steering Position Sensor Output Voltage Inspection

● Measure the output voltage from the steering position sensor.

NOTE

○*Be sure the battery is fully charged*

○Connect a digital voltmeter [A] to the lead connector [B] of the steering position sensor using the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Connections to Steering Position Sensor Connector
Meter (+) → Y/BK Terminal
Meter (–) → BK Terminal

○Turn the ignition switch ON.
○Turn the handlebar fully left or right.
○Measure the output voltage.

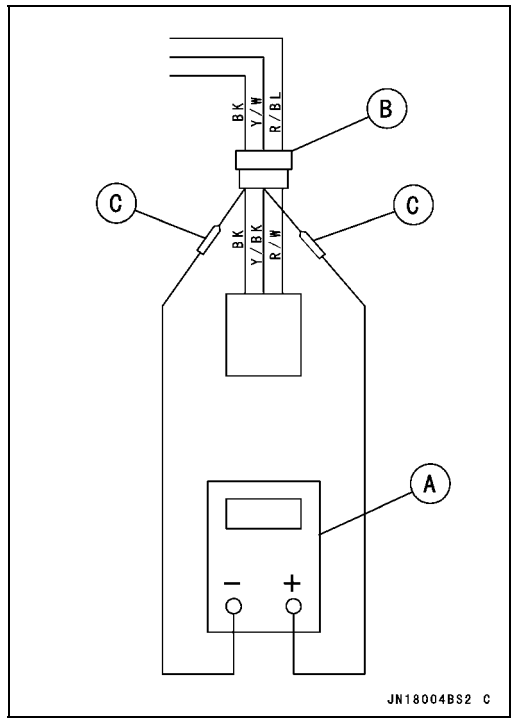
Steering Position Sensor Output Voltage
Standard: approx. 0 V

NOTE

○*When the handlebar is centered in straight-ahead position the output voltage standard value is battery voltage.*

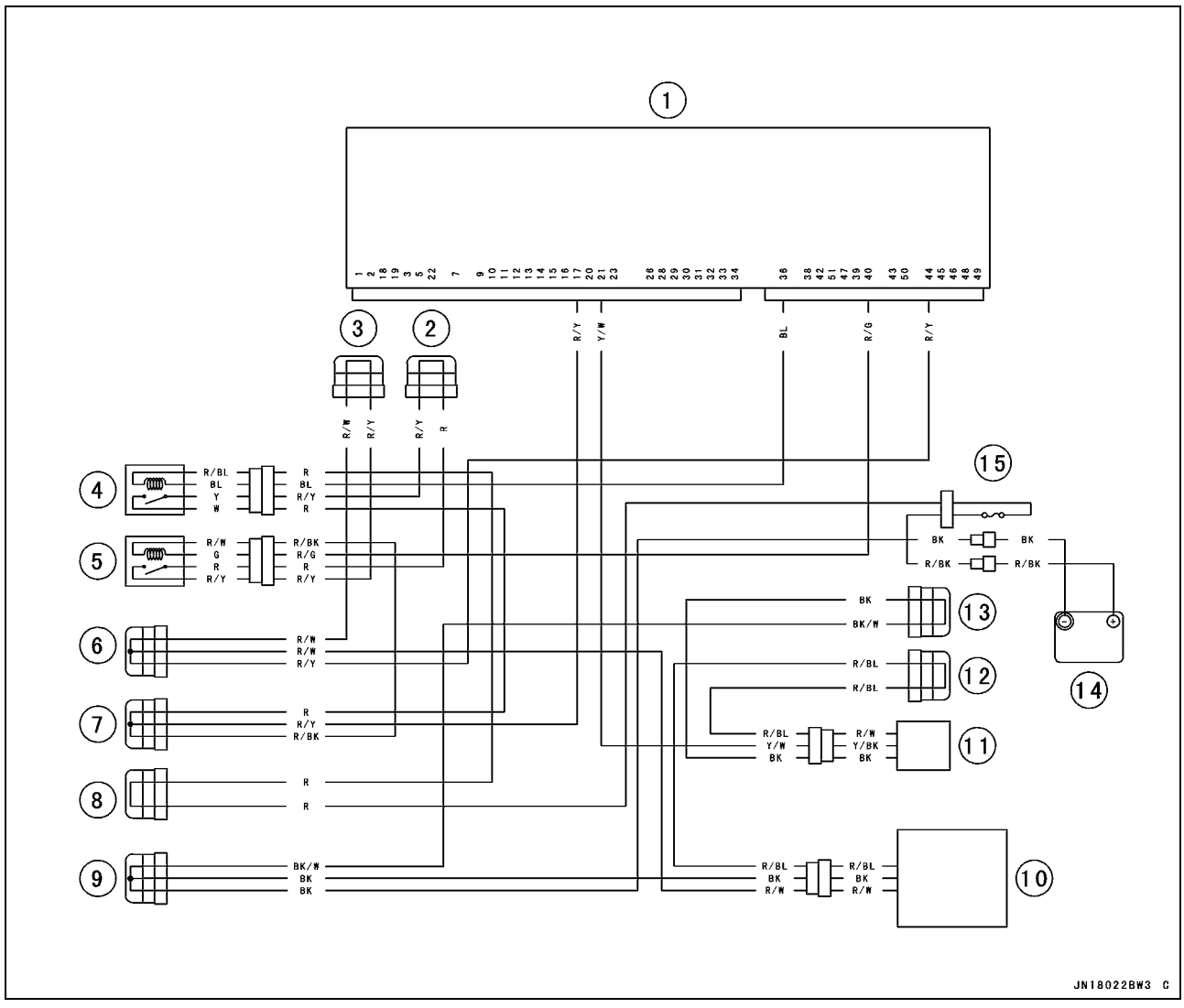
○Turn the ignition switch OFF.

★If the reading is out of the standard, suspect the following.
Damaged Steering Position Sensor
Open Sensor Circuit
★If the reading is the standard, but the Kawasaki Smart Steering system does not operate, suspect the ECU and idle speed control in the throttle body.



Kawasaki Smart Steering System

Steering Position Sensor Circuit



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 3 (Switch (12 V))
7. Joint Connector 2
8. Joint Connector 1
9. Joint Connector 15 (Ground)
10. Multifunction Meter
11. Steering Position Sensor
12. Joint Connector 14
13. Joint Connector 13
14. Battery
15. Main Fuse 20 A

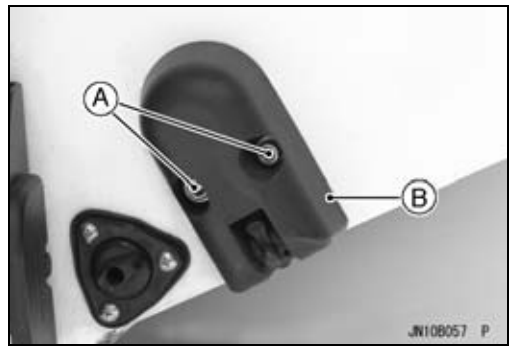
Sensors

Speed Sensor Removal/Installation

● Disconnect the speed sensor connector [A].

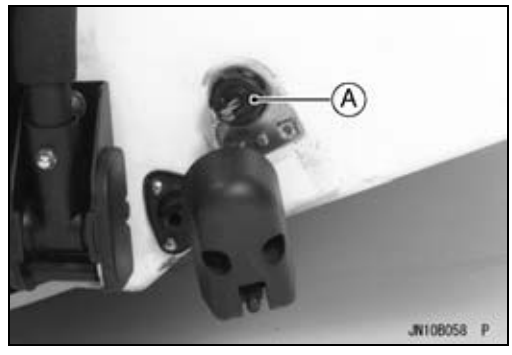
● Unscrew the mounting bolts [A] and remove the speed sensor assembly [B].

○The speed sensor is located at the right of the hull in JT1500B7F model, however it is located at left of the hull in JT1500B8F model.



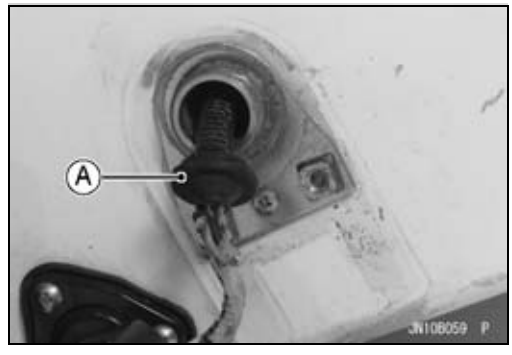
● Unscrew the cap [A].

● Pull out the speed sensor connector and disconnect it.



● When installing the speed sensor assembly, note the following.

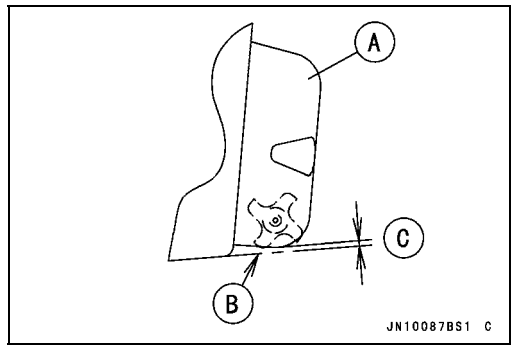
○Apply silicone sealant around the grommet [A] and lead wires.



○Install the speed sensor [A] as shown.

Hull Bottom Line [B]

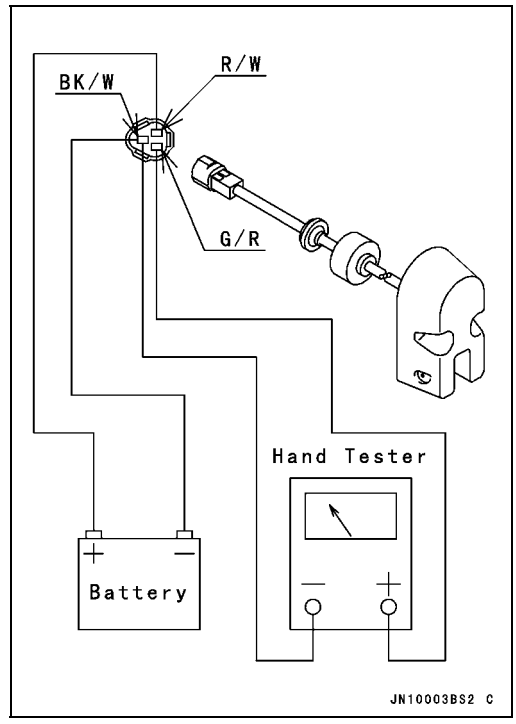
4.5 mm (0.1772 in.) [C]



Sensors

Speed Sensor Inspection

- Remove the speed sensor.
- Connect the battery and tester leads to the sensor as shown.



- Rotate the waterwheel by hand slowly.
- Measure the output voltage of the speed sensor.

G/R (+), BK/W (–) → 0 ~ battery voltage; twice a rotation

(Rotate it slowly.)

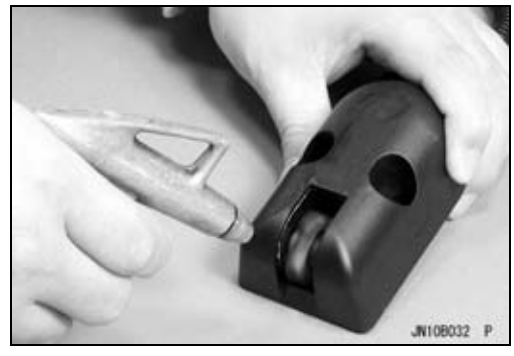
★If the voltage does not rise from zero to battery voltage twice a rotation, replace the sensor.

- Measure the output voltage of the sensor at higher speeds.

○Rotate the waterwheel in a fair speed by air.

G/R (+), BK/W (–) → approx. 5 V

★If the sensor voltage does not reach 5 volts when spun with compressed air, replace the sensor.



Fuel Level Sensor Inspection

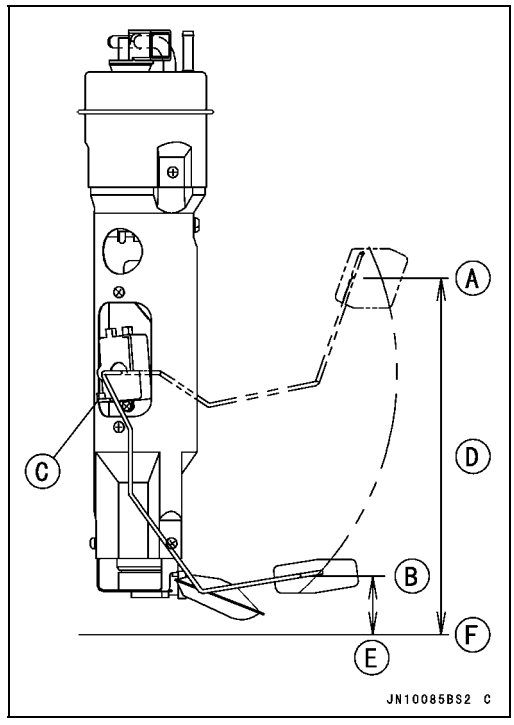
- Remove the fuel pump [A] (see Fuel Pump Removal in the Fuel System (DFI) chapter).

Sensors

- Check that the float moves up and down smoothly without binding. It should go down under its own weight.

★If the float does not move smoothly, replace the sensor.

Float in Full Position [A]
Float in Empty Position [B]
Float Arm Stoppers [C]
235.2 mm (9.2598 in.) from Sensor Base Line [D]
38.8 mm (1.5276 in.) from Sensor Base Line [E]
Fuel Tank Bottom Line [F]

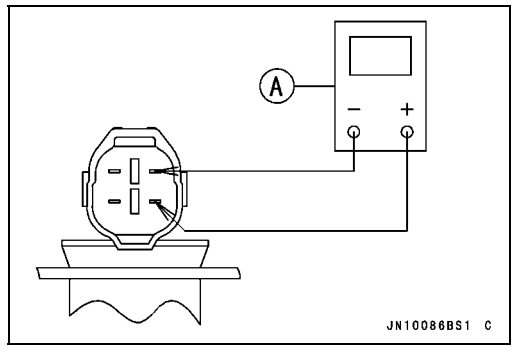


- Using the hand tester [A], measure the resistance across the terminals in the fuel level sensor lead connector.

Special Tool - Hand Tester: 57001-1394

★If the tester readings are not as specified, or do not change smoothly according as the float moves up and down, replace the sensor.

Fuel Level Sensor Resistance
Standard: Full position: 2 ~ 4 Ω
Empty position [C]: 117 ~ 123 Ω



Throttle Sensor Removal/Installation

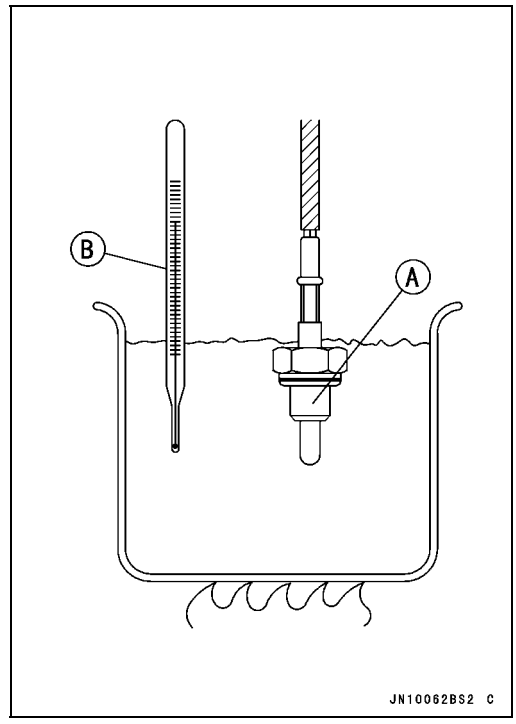
- Refer to Throttle Sensor Removal/Installation in the Fuel System chapter.

Throttle Sensor Inspection

- Refer to Throttle Sensor Section in the Fuel System chapter.

Sensors

Water Temperature Sensor Inspection



- Remove the water temperature sensor (see Fuel (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

NOTE

○*The sensor and thermometer must not touch the container side or bottom.*

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.

★If the hand tester does not show the specified values, replace the sensor.

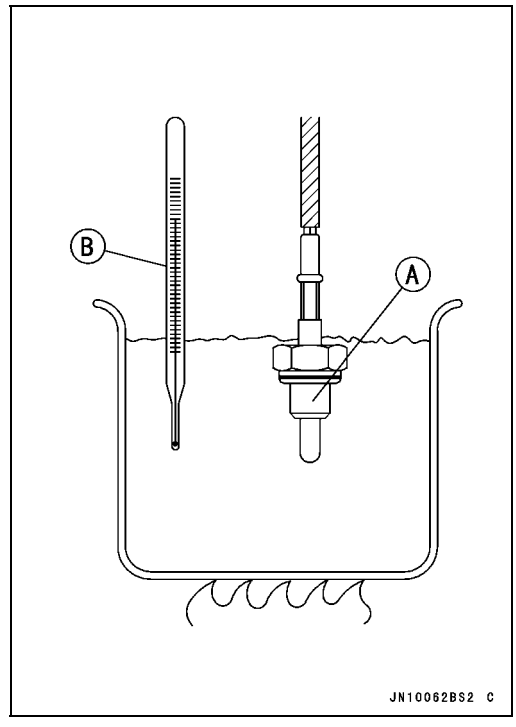
Water Temperature Sensor Resistance

Water Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ

Inlet Air Temperature Sensor Inspection

- Refer to Inlet Air Temperature Sensor Section in the Fuel System chapter.

Oil Temperature Sensor Inspection



- Remove the oil temperature sensor (see Feul (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

NOTE

○*The sensor and thermometer must not touch the container side or bottom.*

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.

★If the hand tester does not show the specified values, replace the sensor.

Oil Temperature Sensor Resistance

Oil Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ

Sensors

Charging Temperature Sensor Inspection

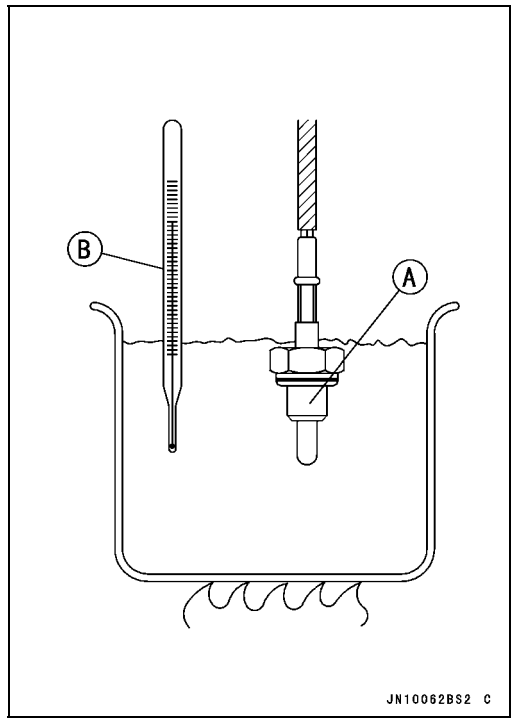
- Remove the charging temperature sensor (see Feul (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

NOTE

○*The sensor and thermometer must not touch the container side or bottom.*

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.

★If the hand tester does not show the specified values, replace the sensor.



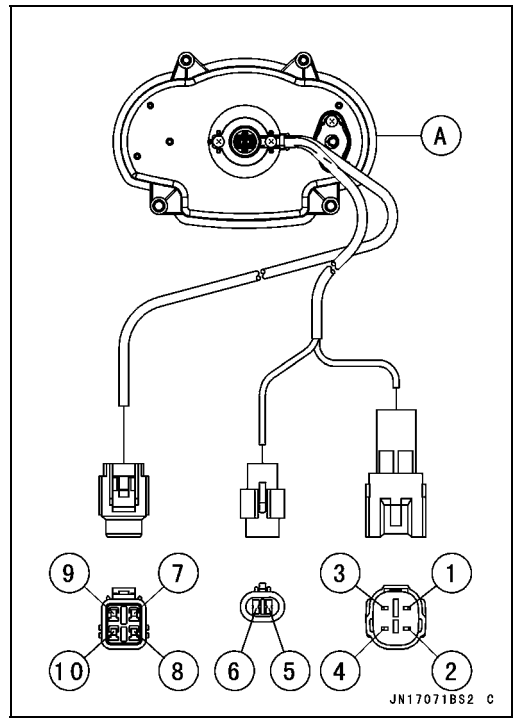
Oil Temperature Sensor Resistance

Oil Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ

Multifunction Meter

Meter Unit Inspection

- Remove the meter unit (see Steering Removal in the Steering chapter) [A].



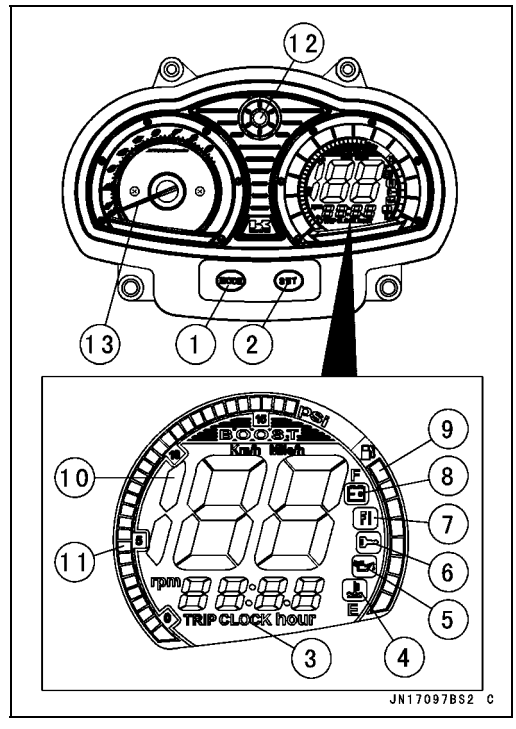
[1] Battery (+): R
[2] Ground (–):BK
[3] Ignition Switch (+): R/W
[4] Speed Sensor (+):R/BL
[5] Buzzer (–): BK/W
[6] Buzzer (+): R/BK
[7] Fuel Level Sensor: W/R
[8] ECU Communication Signal: BL/BK
[9] Speed Sensor Signal: G/R
[10] Unused

Battery Voltage Range: DC 10 ~ 16 V

CAUTION

Do not drop the meter unit. Place the meter unit so that it faces upward. If the meter unit is left up side down or side ways for a long time or dropped, it will malfunction. Do not short each terminals.

Display Function Inspection



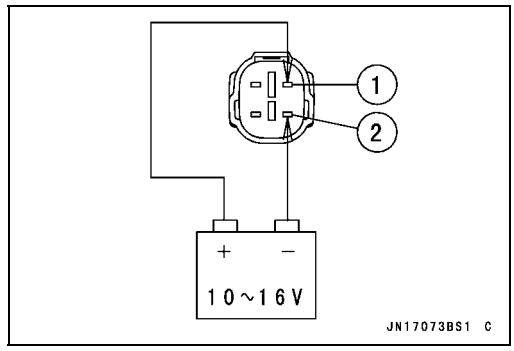
[1] MODE Button
[2] SET Button
[3] Multifunction Display
[4] Engine Cooling Water Temperature Indicator
[5] Engine Oil Pressure Indicator
[6] Immobilizer Indicator
[7] FI Indicator
[8] Low Battery Voltage Indicator
[9] Fuel Level Gauge
[10] Speedometer
[11] Boost Meter
[12] “LED” Warning Light
[13] Tachometer (Analogue)

CAUTION

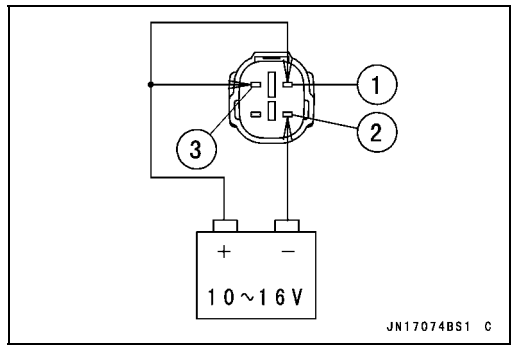
If the multifunction meter displays incorrectly while engine is running, first disconnect the battery negative (–) terminal cable and reconnect it again to recover the meter display.
Then check to see that the standard plugs and/or plug caps are installed. Install only the standard plugs and/or plug caps. The resistors are embedded in both parts.

Multifunction Meter

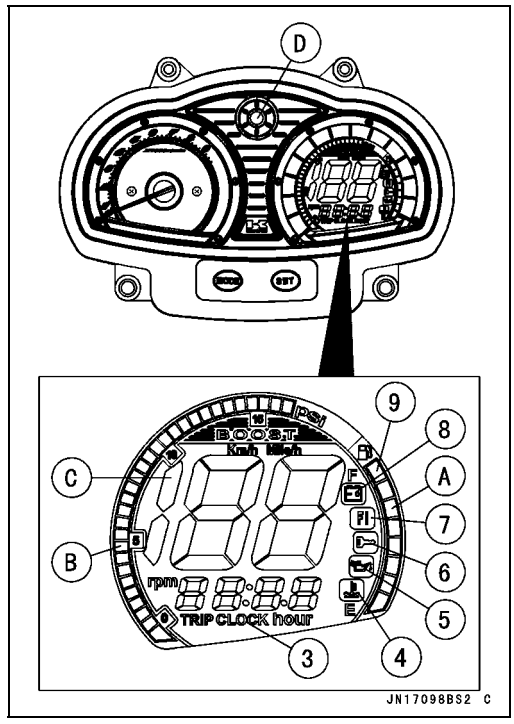
● Using the auxiliary wires, connect the 12 V battery to the meter unit connector as follows.
○Connect the battery positive terminal to the terminal [1].
○Connect the battery negative terminal to the terminal [2].



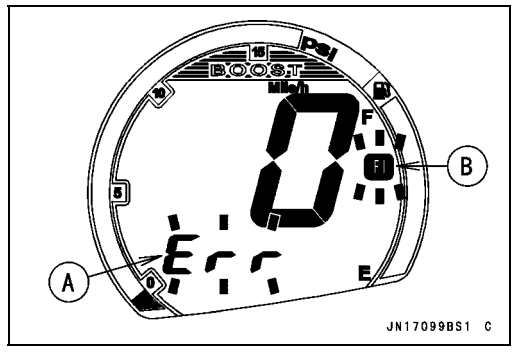
● Connect the terminal [3] to the terminal [1].



● When the terminal are connected, confirm whether the display function operates as follows.
○The fuel level gauge [A] and boost meter [B] momentary points to the last reading, and then return to the 0 position.
○The other LCD segments [C] appear for several seconds.
○The LED warning light [D] is lit.
★If the display function does not operate, replace the meter unit.
● Check that when the terminal [3] is disconnected, all the LCD segments and LED warning light disappear.
★If the LCD segments and LED warning light do not disappear, replace the meter unit.



● Connect the terminal [3] to the terminal [1] again.
● About 10 seconds after, check that the Err character [A] and FI indictor [B] appear in the display.
○The Err character and FI indicator are flashing.
★If the Err character and FI indicator do not appear, replace the meter unit.



NOTE

○*This meter unit has a failure detection function of the ECU communication. When the ECU communication error was detected, the meter unit alert the rider by the Err character and FI indicator appear in the display.*
○*When the failure detection function operates with the meter unit installed on the watercraft, check the ECU and wiring.*

Multifunction Meter

Tachometer (Analogue) Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.

○When the terminals are connected, the tachometer needle momentary points to the last reading, and then return to the 0 position.

★If the needle function does not work, replace the meter unit.

Fuel Level Warning Inspection

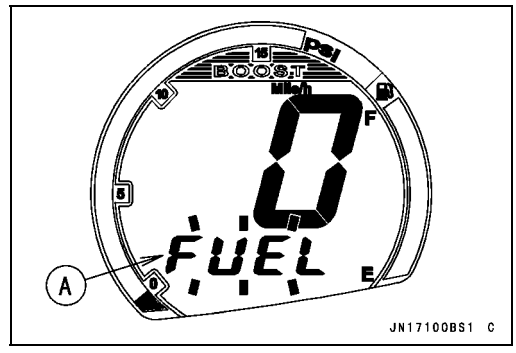
- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- When the terminals are connected, check that the FUEL character [A] appear in the display.

○The FUEL character is flashing.

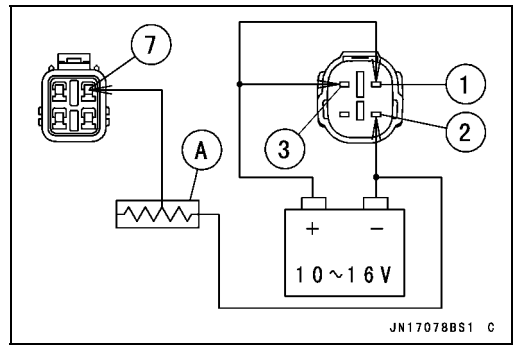
NOTE

○*When the Err character and FI indicator appear in the display, FUEL character do not appear.*

★If the display function does not work, replace the meter unit.



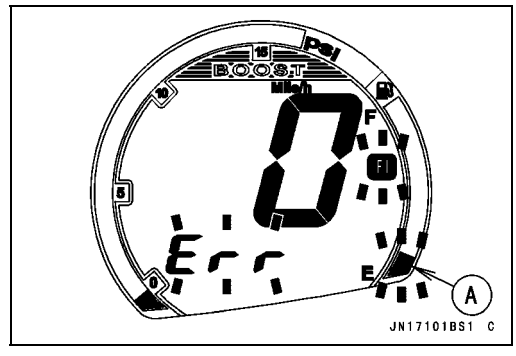
- Connect the variable resistor [A] to the terminal [7] as shown.
- Adjust the resistance value to the approximately 60 Ω.



- About 10 seconds after, check that the one segment [A] in the fuel level gauge appear.

○The one segment in the fuel level gauge is flashing.

★If the display function does not work, replace the meter unit.



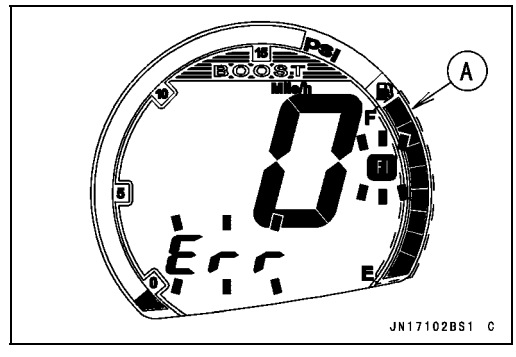
Fuel Level Gauge Inspection

- Connect the 12 V battery, terminals and variable resistor in the same manner as specified in the “Fuel Level Warning Inspection”.
- Check that the number of character matches the resistance value of the variable rheostat in the table below.

○When the terminal is connected, one segment in the fuel level gauge should appear about every 10 seconds.

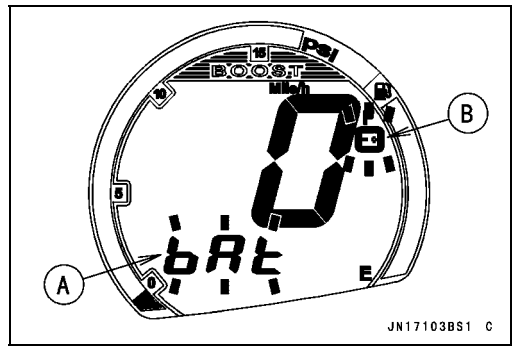
Variable Rheostat Resistance (Ω)	Display Segments [A]
80 Ω	0
5 Ω	8

★If the display function does not work, replace the meter unit.



Multifunction Meter

Low Battery Voltage Warning Inspection



- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- When the input voltage to the terminal [1] is lowered to 11.5 V or less, check that the bAt character [A] and low battery voltage indictor [B] appear in the display.

○The bAt character and low battery voltage indictor are flashing.

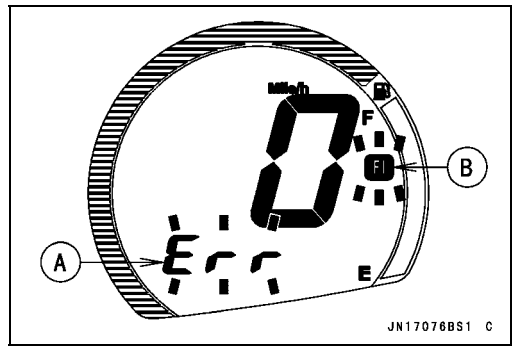
○The FUEL character and bAt character appear alternately in the multifunction display.

NOTE

○*When the Err character and FI indicator appear in the display, bAt character and low battery voltage indictor do not appear.*

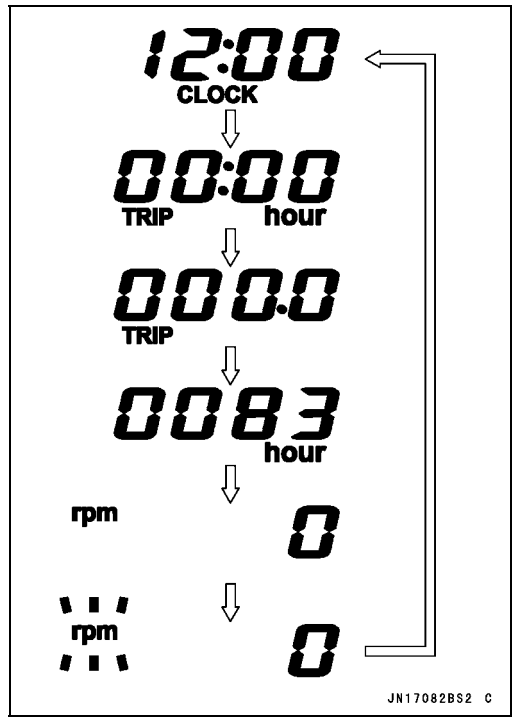
★If the display function does not work, replace the meter unit.

MODE AND SET Button Operation Check



- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Check”.

○When the Err character [A] and FI indicator [B] appear in the display, push and hold the MODE button or SET button for more than one second. The Err character disappear and then normal display appear.



- By pushing the MODE button each time, check that the multifunction display change to the clock, time, trip, hour, engine rpm and maximum speed/engine rpm.

○The "rpm" display in the maximum speed/engine rpm mode is flashing.

○When the MODE button is pushed and held continuously, the display rotates through the six modes.

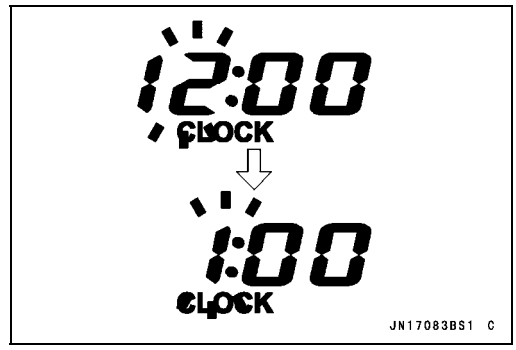
★If the display function does not work, replace the meter unit.

Multifunction Meter

- Indicate the clock mode.
- Check that when the SET button in clock mode is pushed for more than two seconds, the display turns to HOUR setting mode.

○The hour display starts flashing.

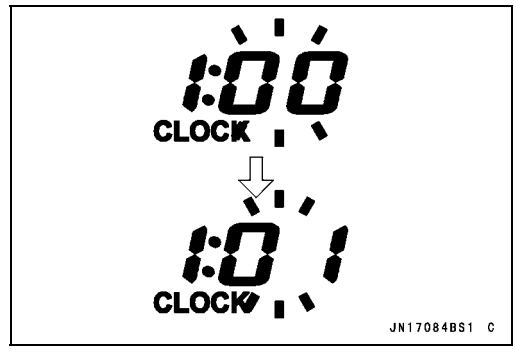
★Press the MODE button to set the hour.



- In the HOUR setting mode, press the SET button again to effect the MINUTE setting mode.

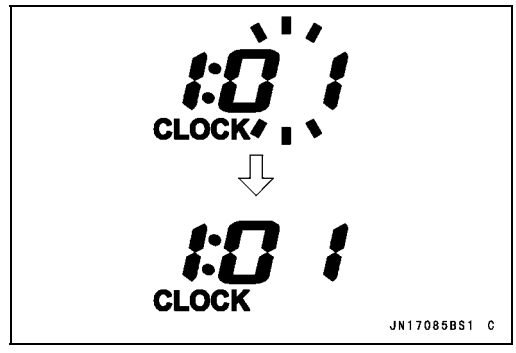
○The minute display starts flashing.

- Press the MODE button to set the minute.



- In the MINUTE setting mode, press the SET button to complete the time setting process.

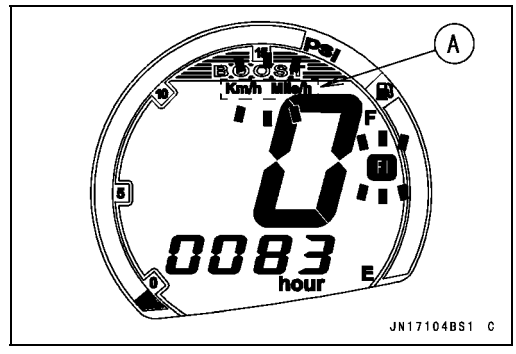
★If the display function does not work, replace the meter unit.



- Indicate the hour meter mode.
- Check that the display [A] change to the Km/h or Mile/h display each time by pushing the SET button for more than three seconds.

○The Km/h or Mile/h display starts flashing and the hour meter display disappear.

★If the display function does not work, replace the meter unit.



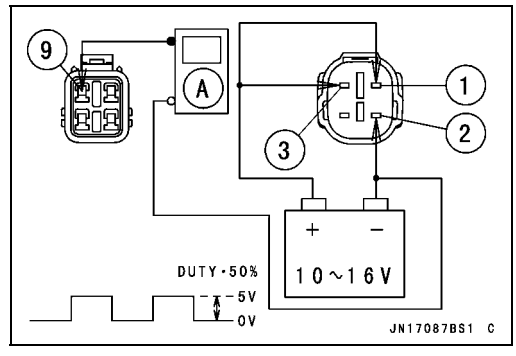
Speedometer Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- The speed equivalent to the input frequency is indicated in the oscillator [A], if the square wave (illustrated as shown) would be input into the terminal [9].

○Indicates approximately 64 km/h in case the input frequency would be approximately 182 Hz.

○Indicates approximately 40 mile/h in case the input frequency would be approximately 182 Hz.

★If the speedometer does not work, replace the meter unit.



Multifunction Meter

★If the oscillator is not available, the speedometer can be checked as follows.
○Install the meter unit.
○Turn on the ignition switch.
○Rotate the waterwheel by hand.
○Check that the speedometer shows the speed.
★If the speedometer does not work, check the following.
Speed Sensor Electric Source Voltage (see Speed Sensor Power Supply Inspection)
Speed Sensor (see Speed Sensor Inspection)
Wiring (see wiring diagram in this section)
★If the speed sensor power supply, speed sensor and wiring are good, replace the meter unit.

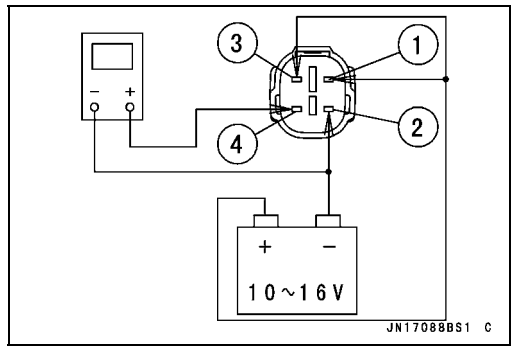
Speed Sensor Power Supply Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
- Set the hand tester to the DC 25 V range and connect it in the meter unit as follows.

Special Tool - Hand Tester: 57001-1394

Connections:

Hand Tester (+)	**→ Terminal [4]**
Hand Tester (–)	**→ Terminal [2]**



★If the voltage is less than the 7 V, replace the meter unit.

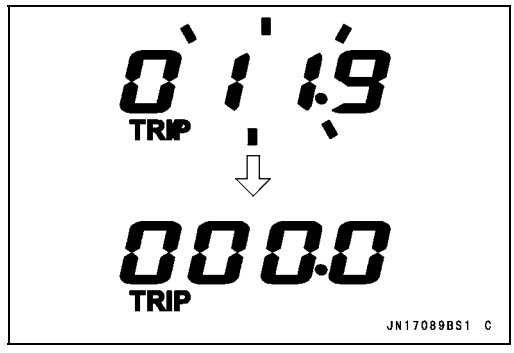
Trip Meter Inspection

- Check the trip meter with the speedometer in the same way.
- Indicate the trip meter.

★If the value indicated in the trip meter is not changed, replace the meter unit.

- Check that when the SET button is pushed for more than two seconds, the figure display turns to “000.0”.

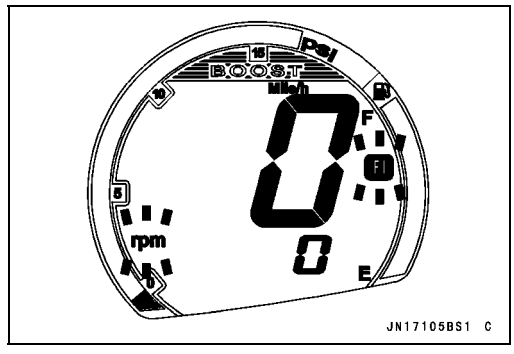
○The trip meter display starts flashing.
★If the display function does not work, replace the meter unit.



Maximum Speed/Engine rpm display Inspection

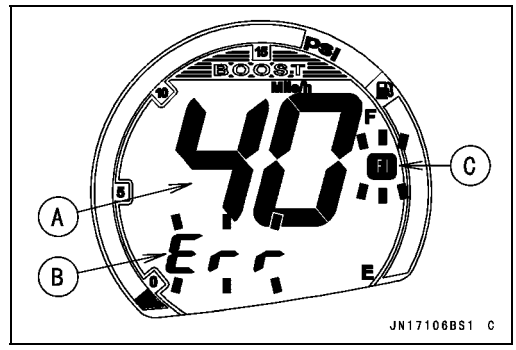
- Check the maximum speed/engine rpm display with the speedometer in the same way.
- Indicate the maximum speed/engine rpm mode.

○The display shows the 0 km/h or 0 mile/h and 0 rpm.

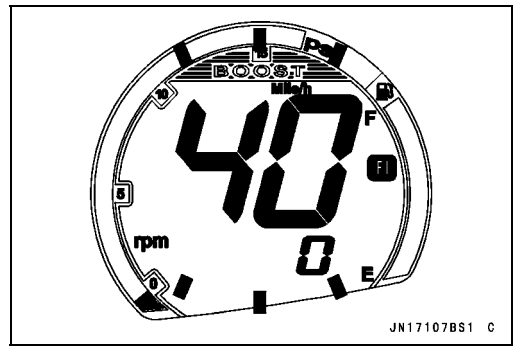


Multifunction Meter

● Disconnect the terminal [3] temporary and connect again.
○When oscillator input frequency is approximately 182 Hz, the display [A] shows the approximately 64 km/h or approximately 40 mile/h.
★If the display function does not work, replace the meter unit.
○When the Err character [B] and FI symbol [C] appear in the display, push and hold the MODE button for more than one second. The Err character disappears and then normal display appears.



● Check that when the SET button is pushed for more than two seconds, the figure display turns to 0 km/h or 0 mile/h.
○All the LCD segments [A] start flashing for several seconds.
★If the display function does not work, replace the meter unit.



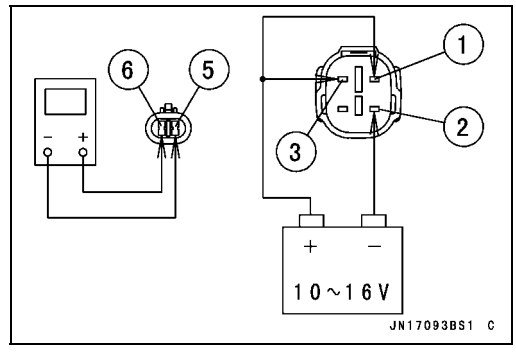
Buzzer Operating Voltage Inspection

● Connect the 12 V battery and terminals in the same manner as specified in the “Display Function Inspection”.
● Set the hand tester to the DC 25 V range and connect it in the meter unit as follows.

Special Tool - Hand Tester: 57001-1394

Connections:

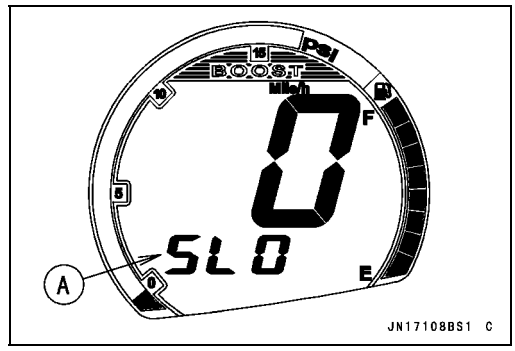
Hand Tester (+)	**→ Terminal [6]**
Hand Tester (–)	**→ Terminal [5]**



○The tester needle alternately shows about 2 V and about 10 V.
★If the tester does not read as specified, replace the meter unit.
● Push the MODE button or SET button.
○The tester needle shows 0 V.
★If the tester does not read as specified, replace the meter unit.

Multifunction Meter

SLO (Smart Learning Operation) Mode Display Inspection



NOTE

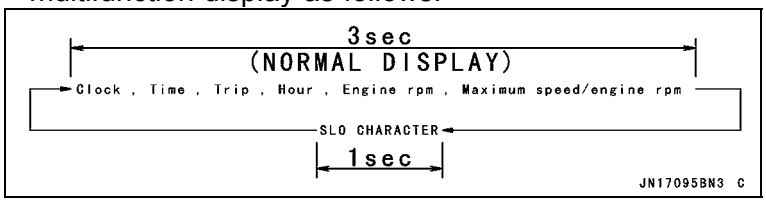
○*Inspect with the meter unit installed on the watercraft.*

- Confirm the SLO mode display, following the specified sequence.

○First, using the SLO mode ignition key (yellow-colored and marked SLO), turn the ignition switch ON.

○Second, check that the same initial display when ignition switch turned ON is shown together with two times buzzer sound.

○Lastly, check that the SLO character (1 second) [A] and normal display (3 seconds) are shown alternately in the multifunction display as follows.



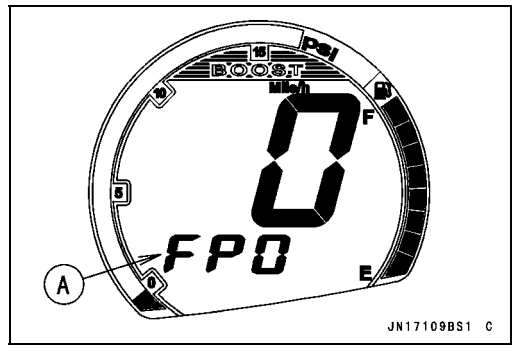
NOTE

○*Under the SLO mode, all the meter displays and other functions work in the same manner as the normal operation (Full Power Operation, FPO) mode.*

○*When the warning (fuel level warning etc.) was detected, SLO character and normal display do not appear (warning character appear).*

★If the display function does not work, replace the meter unit.

FPO (Full Power Operation) Mode Display Inspection



NOTE

○*Inspect with the meter unit installed on the watercraft.*

- Confirm the FPO mode display, following the specified sequence.

○First, using the FPO mode ignition key (orange-colored), turn the ignition switch ON.

○Second, check that the same initial display when ignition switch turned ON is shown together with two times buzzer sound.

○Third, check that the FPO character [A] appears in the multifunction display.

○Lastly, check that the FPO character disappears and then normal display appears.

NOTE

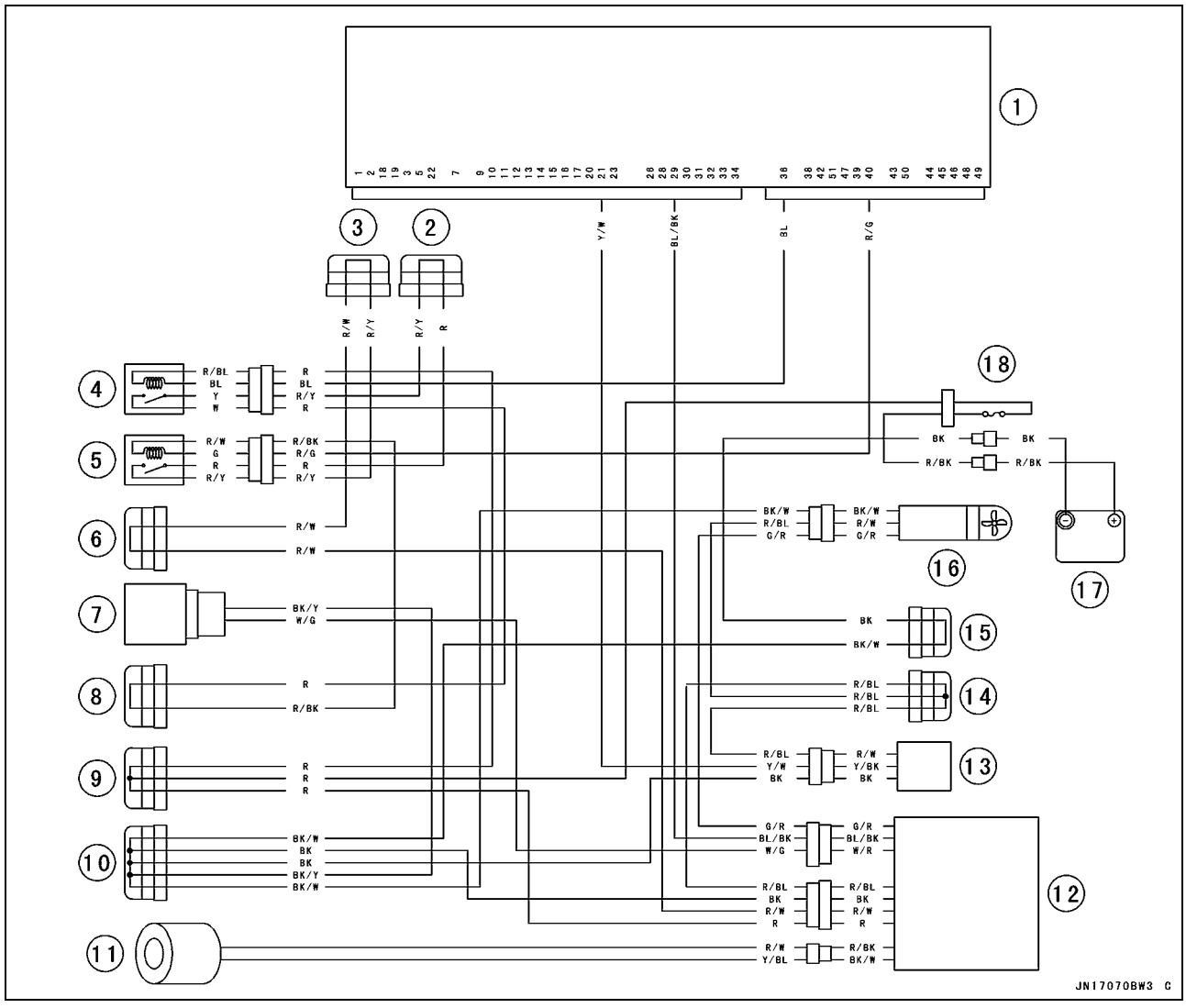
○*The FPO character is shown only once.*

○*When the warning (fuel level warning etc.) was detected, normal display does not appear (warning character appear).*

★If the display function does not work, replace the meter unit.

Multifunction Meter

Multifunction Meter Circuit



1. ECU
2. Joint Connector 8 (Vcc)
3. Joint Connector 7 (Vcc)
4. System Relay
5. Main (ECU) Relay
6. Joint Connector 3 (Switch (12 V))
7. Fuel Pump
8. Joint Connector 2
9. Joint Connector 1
10. Joint Connector 15 (Ground)
11. Buzzer
12. Multifunction Meter
13. Steering Position Sensor
14. Joint Connector 14
15. Joint Connector 12 (Ground)
16. Speed Sensor
17. Battery
18. Main Fuse 20A

Immobilizer System

This watercraft is equipped with an immobilizer system to protect the watercraft from theft. This system provides a theft proof device by means of matching a code between the inbuilt key transponder and ECU (Electronic Control Unit). If the code does not match, ignition system, injectors and fuel pump will not operate and the engine will not start.

Abstract

- If the LED warning light, immobilizer indicator and the following character blink, and the buzzer sound goes off after the key is pressed, this shows a fault in the immobilizer system.
  Err-Immobilizer Communication Trouble
  IdA-Immobilizer Amplifier Failure (Service Code: 35)
  IdEr-Not Matching Key Code (Service Code: 36)

Refer to the service code or character to identity the faulty component.

- If all coded keys (FPO key-full power operation mode: orange-colored and SLO key-smart learning operation mode: yellow-colored and marked SLO) are lost the ECU will have to be replaced.
- The immobilizer system can not function until the user key code is registered in the ECU.
- A total of six keys can be registered in the ECU at any one time .

Operational Cautions

1. Do not expose the keys to excessively high temperature.
2. Do not place keys close to magnets.
3. Do not place a heavy item on any key.
4. Do not damage the plastic covers.
5. Do not give shocks to the keys.
6. One registered key is needed to have a new key (or keys) registered to ECU.
7. If both registered keys have been lost, renew the ECU.

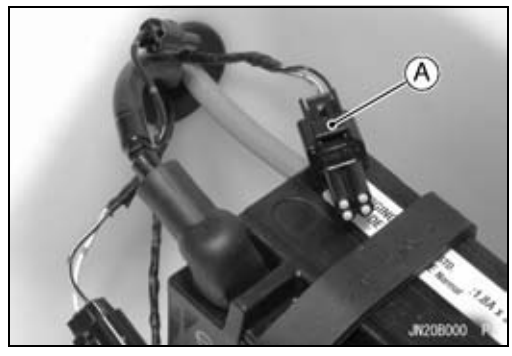
NOTE

○*Since the immobilizer system uses the electric wave for communication, key identification error may occur where other electric waves abound.*

Key Registration

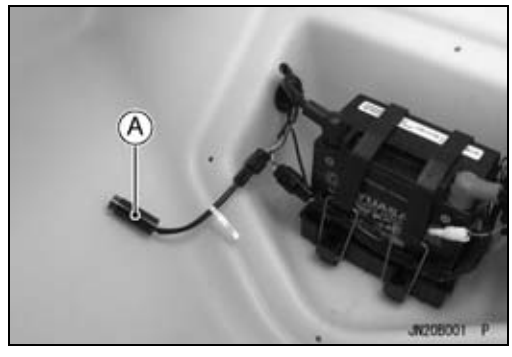
Case 1: When the user key has been lost or additional spare user key is required.

- Prepare a new spare user key.
- Open the front storage lid and remove the front storage case.
- Disconnect the connector for DIAG and key registration [A].



- Connect the key registration unit [A].

  Special Tool - Key Registration Unit: 57001-1582



Immobilizer System

Pre-registration of User Key 1

● Insert the registered key (user key 1) to the ignition switch and press key [A] for a short time (within 2 seconds).

Verified

● The ECU confirms the following.

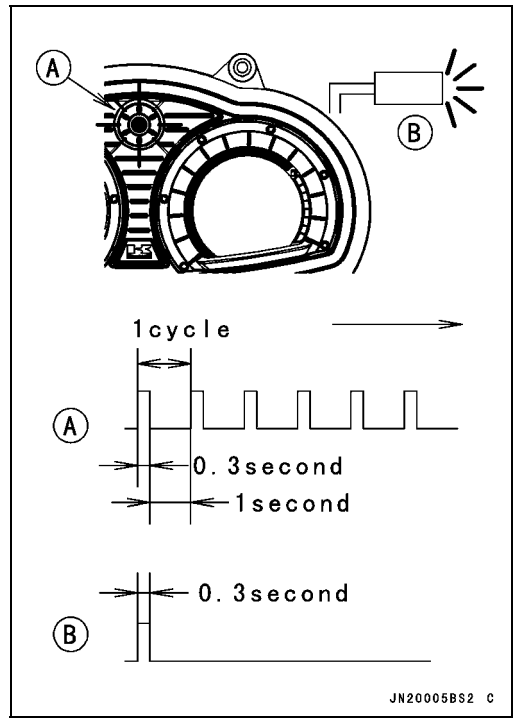
○Receiving signals from immobilizer amplifier are correct.

○The user key 1 is registered.

● All user key codes in ECU are eliminated.

● The user key 1 is successfully pre-registered in the ECU.

○The LED warning light [A] blinks 1 time and stops for 1 second and then repeats this cycle. Also the buzzer sound [B] goes off 1 time.



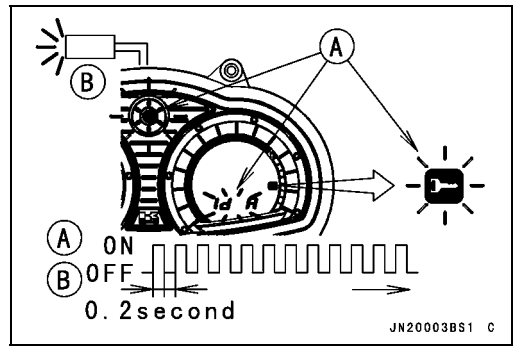
NOTE

○*Only the first one cycle, the buzzer sound goes off synchronizing with the blink of LED warning light.*

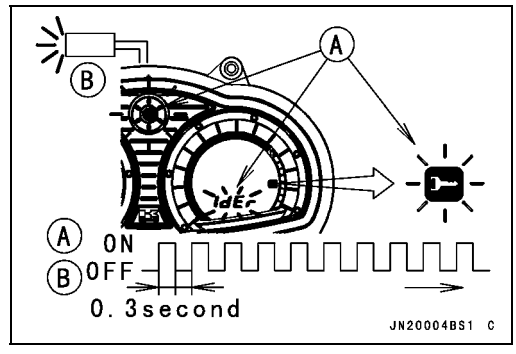
Not Verified

○The LED warning light, immobilizer indicator and character [A] blink to display the collation error. The buzzer sound goes off [B]. (refer to the following failure illustrations).

Immobilizer Amplifier Failure (Service Code/Character -35/Id A)



Key Collation Error (Service Code/Character-36/IdEr)



Immobilizer System

Pre-registration of User Key n (2 ~ 6)

- Remove the user key 1 and insert the unregistered key (user key 2) and press key for a short time (within 2 seconds).

NOTE

○*Continue with the procedure to register the second and later keys before the 15 seconds period has elapsed, the registration mode automatically finishes and the warning indicator light (LED) will switch off.*

○*At this procedure, the unregistered key (user key 2) is pressed for a long time (2 seconds or more), the procedure goes to the regular registration of user key (see Regular Registration of User Key).*

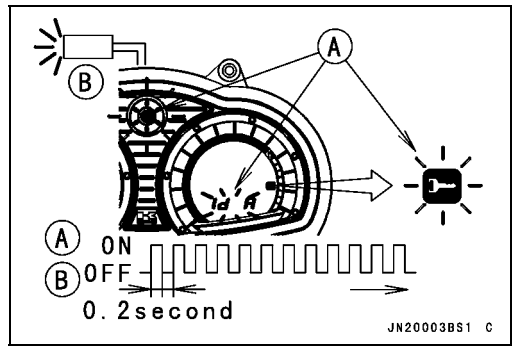
- The ECU confirms the following.

○Receiving signals from immobilizer amplifier are correct.
○The user key n (2 ~ 6) code is unregistered.
○The key registration number must be six or less.

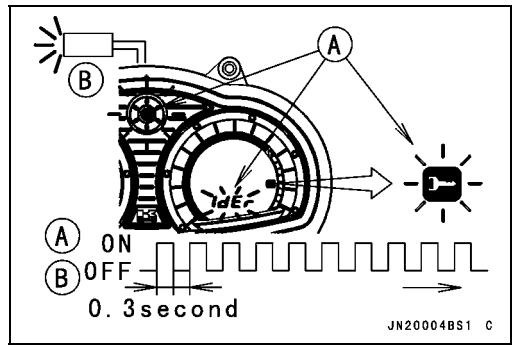
Not Verified

○The LED warning light, immobilizer indicator and character [A] blink to display the collation error. The buzzer sound goes off [B]. (refer to the following failure illustrations).

Immobilizer Amplifier Failure (Service Code/Character -35/Id A)



Key Collation Error (Service Code/Character-36/IdEr)

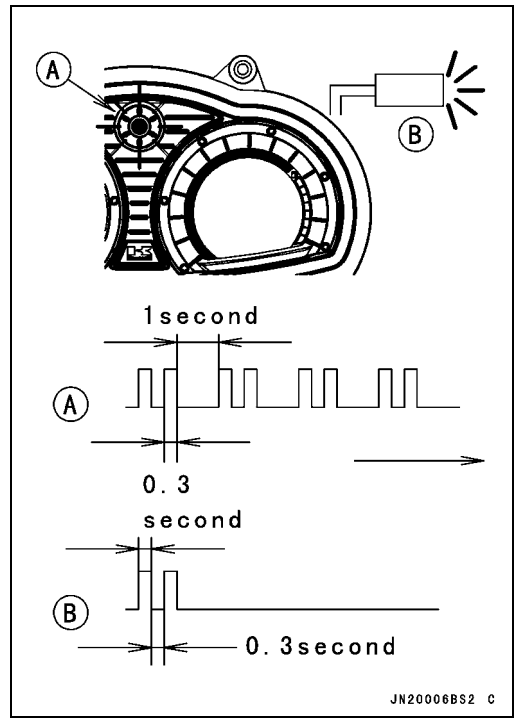


Immobilizer System

● The user key 2 is successfully pre-registered in the ECU.
○The LED warning light [A] blinks 2 times and stops for 1 second and then repeats this cycle. Also the buzzer [B] sound goes off 2 times.

NOTE

○*Only the first one cycle, the buzzer sounds goes off synchronizing with the blink of LED warning light.*



● Continue the procedures to register additional 4 user keys.

NOTE

○*The ECU can store up the six key codes (FPO key × n and SLO key × n).*

Warning Light Flash and Buzzer Sound

	LED Warning Light Blinks and Buzzer Sound	LED Warning Light Blinks and Buzzer Sound Stop	Remarks
User Key 3	3 times	1 second	Repeat
User Key 4	4 times	1 second	Repeat
User Key 5	5 times	1 second	Repeat
User Key 6	6 times	1 second	Repeat

NOTE

○*Only the first cycle, the buzzer sound goes off synchronizing with the blink of LED warning light.*

Regular Registration of User Key

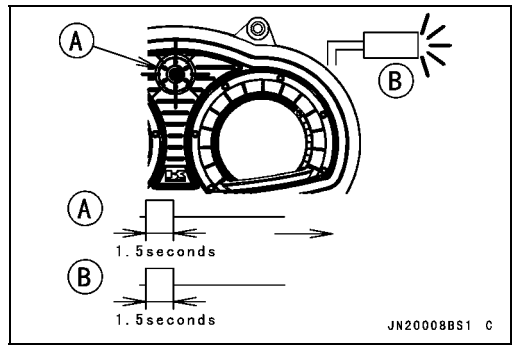
● Leave the user key (1 ~ 6) in the ignition switch.
● Press key for a long time (2 seconds or more).
● The ECU confirms the following.
○Receiving signals from immobilizer amplifier are correct.
○The user key is the same as the key pre-registered at the end.

NOTE

○*When the user key is not the same with the key pre -registered at the end, registration mode will end instantaneously. Start the procedure, pre-registration of user key 1.*

Immobilizer System

● The user key is registered regularly in the ECU.
○The LED warning light [A] blinks 1 time for 1.5 seconds and the buzzer sound [B] goes off 1 time synchronizing with the blink of LED warning light.



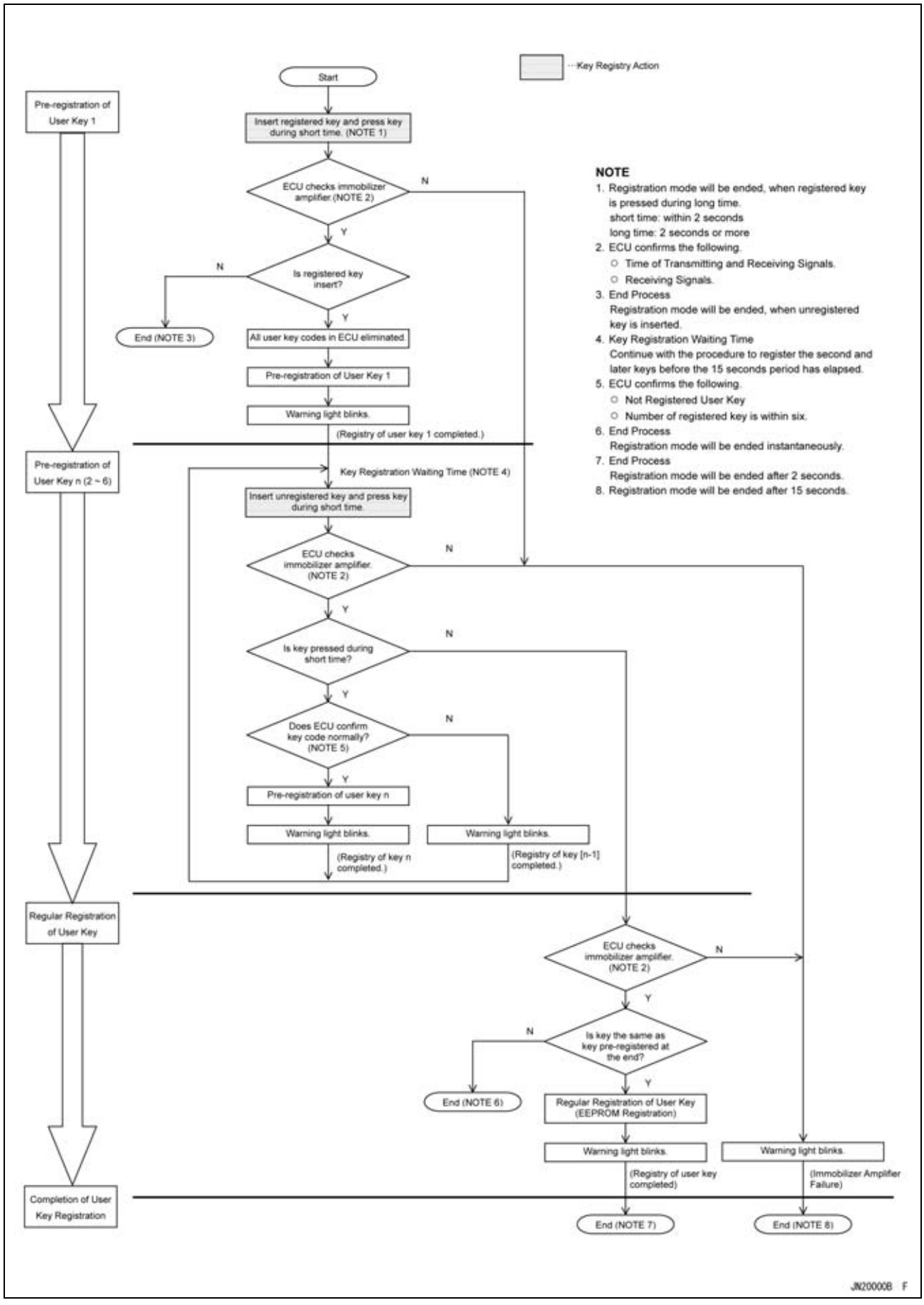
● The registration mode automatically ends.
● Remove the key registration unit and connect the connector for DIAG and key registration.

NOTE

○*Insert the registered user key and press them.*
○*Check that the engine can be started using all registered user keys.*

Immobilizer System

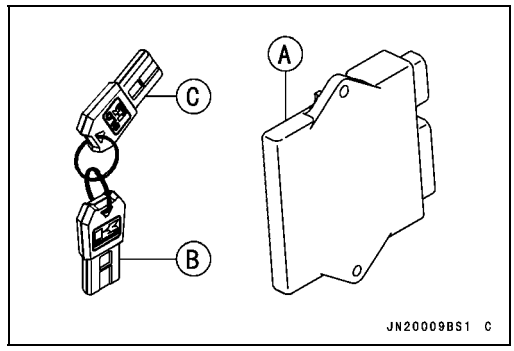
Spare User Key Registration Flow Chart


Key Registry Action
Start
Pre-registration of User Key 1
Insert registered key and press key during short time. (NOTE 1)
ECU checks immobilizer amplifier.(NOTE 2)
N
Y
Is registered key insert?
N
Y
End (NOTE 3)
All user key codes in ECU eliminated.
Pre-registration of User Key 1
Warning light blinks.
(Registry of user key 1 completed.)
Pre-registration of User Key n (2 ~ 6)
Key Registration Waiting Time (NOTE 4)
Insert unregistered key and press key during short time.
ECU checks immobilizer amplifier. (NOTE 2)
N
Y
Is key pressed during short time?
N
Y
Does ECU confirm key code normally? (NOTE 5)
N
Y
Pre-registration of user key n
Warning light blinks.
(Registry of key n completed.)
Warning light blinks.
(Registry of key [n-1] completed.)
Regular Registration of User Key
ECU checks immobilizer amplifier. (NOTE 2)
N
Y
Is key the same as key pre-registered at the end?
N
Y
End (NOTE 6)
Regular Registration of User Key (EEPROM Registration)
Warning light blinks.
(Registry of user key completed)
Warning light blinks.
(Immobilizer Amplifier Failure)
Completion of User Key Registration
End (NOTE 7)
End (NOTE 8)
NOTE
1. Registration mode will be ended, when registered key is pressed during long time.
short time: within 2 seconds
long time: 2 seconds or more
2. ECU confirms the following.
○ Time of Transmitting and Receiving Signals.
○ Receiving Signals.
3. End Process
Registration mode will be ended, when unregistered key is inserted.
4. Key Registration Waiting Time
Continue with the procedure to register the second and later keys before the 15 seconds period has elapsed.
5. ECU confirms the following.
○ Not Registered User Key
○ Number of registered key is within six.
6. End Process
Registration mode will be ended instantaneously.
7. End Process
Registration mode will be ended after 2 seconds.
8. Registration mode will be ended after 15 seconds.
JN200008 F

Immobilizer System

Case 2: When the electric control unit (ECU) is faulty and has to be replaced.

● Prepare the following.
New ECU [A]
Current FPO Key [B] (Full Power Operation Mode: orange-colored)
Current SLO Key [C] (Smart Learning Operation Mode: yellow-colored and marked SLO)



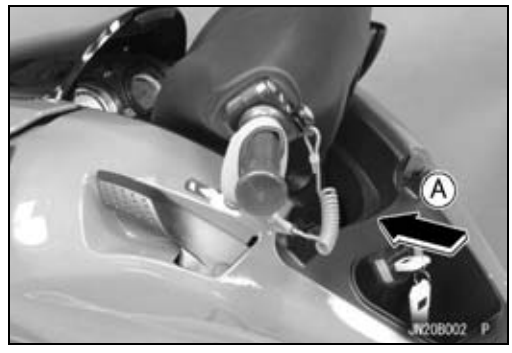
NOTE

○*The key registration unit is not required.*

● Replace:
ECU (see Immobilizer System Parts Replacement)

Pre-registration of User Key 1

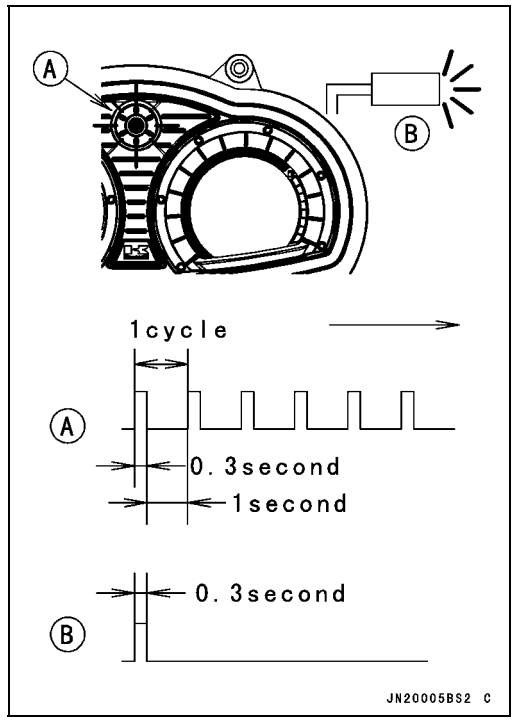
● Insert the current key (user key 1) to the ignition switch and press key [A] for a short time (within 2 seconds) or long time (2 seconds or more).



Verified

● The ECU confirms the following.
○Receiving signals from immobilizer amplifier are correct.

● The user key 1 is successfully pre-registered in the ECU.
○The LED warning light [A] blinks 1 time and stops for 1 second and then repeats this cycle. Also the buzzer sound [B] goes off 1 time.

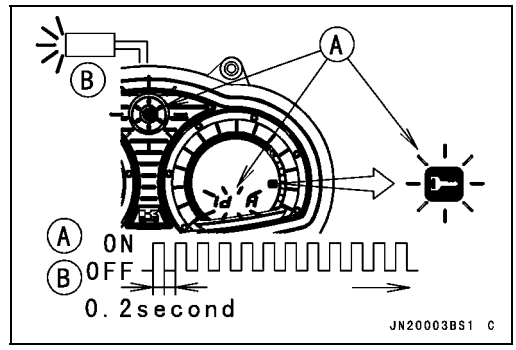


Immobilizer System

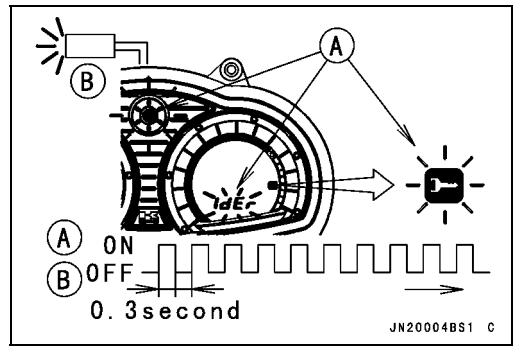
Not Verified

○The LED warning light, immobilizer indicator and character [A] blink to display the collation error. The buzzer sound goes off [B]. (refer to the following failure illustrations).

Immobilizer Amplifier Failure (Service Code/Character -35/Id A)



Key Collation Error (Service Code/Character-36/IdEr)



Pre-registration of User Key 2

● Remove the user key 1 and insert the user key 2 and press key for a short time (within 2 seconds) or long time (2 seconds or more).

NOTE

○*Continue with the procedure to register the first and second keys before the 15 seconds period has elapsed the registration mode automatically finishes and the warning indicator light (LED) will switch off.*

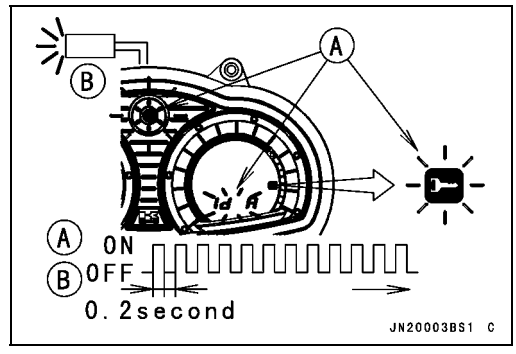
● The ECU confirms the following.

○Receiving signals from immobilizer amplifier are correct.

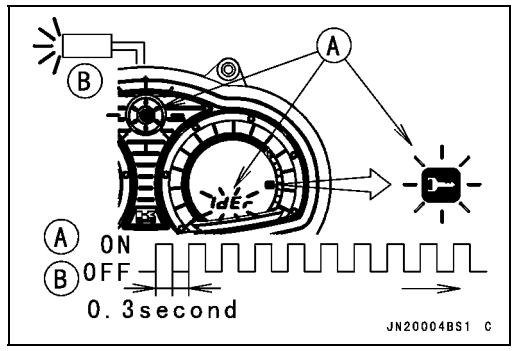
Not Verified

○The LED warning light, immobilizer indicator and character [A] blinks to display the collation error. The buzzer sound goes off [B]. (refer to the following failure illustrations).

Immobilizer Amplifier Failure (Service Code/Character -35/Id A)



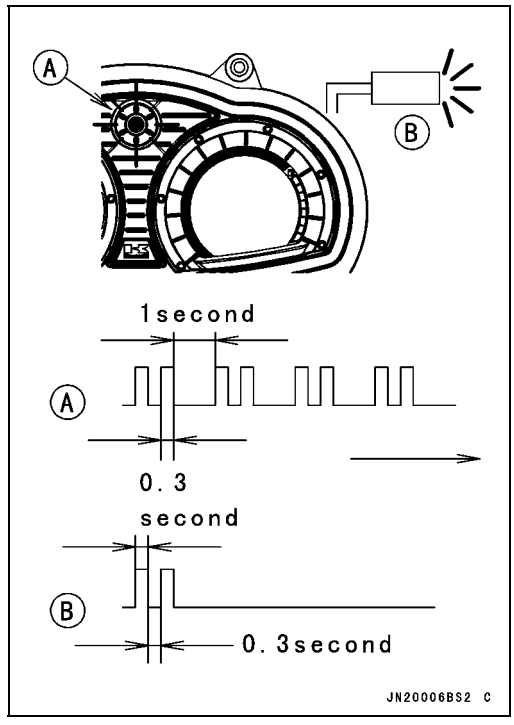
Key Collation Error (Service Code/Character-36/IdEr)



● The user key 2 is successfully pre-registered in the ECU.
○The LED warning light [A] blinks 2 times and stops for 1 second and then repeats this cycle. Also the buzzer [B] sound goes off 2 times.

NOTE

○*Only the first one cycle, the buzzer sounds goes off synchronizing with the blink of LED warning light.*



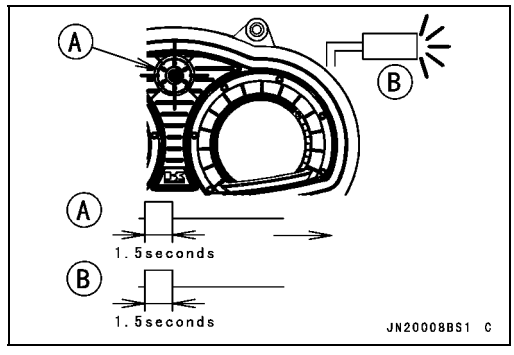
Regular Registration of User Key

● Leave the user key 2 in the ignition switch.
● Press key for a long time (2 seconds or more).
● The ECU confirms the following.
○Receiving signals from immobilizer amplifier are correct.
○The user key is the same with the user key 2.

NOTE

○*When the user key is not the same as the user key 2, registration mode will be end instantaneously. Start the procedure, pre-registration of user key 1.*

● The user key is registered regularly in the ECU.
○The LED warning light [A] blinks 1 time for 1.5 seconds and the buzzer sound [B] goes off 1 time synchronizing with the blink of LED warning light.



Immobilizer System

● The registration mode automatically ends.

NOTE

○*Insert the registered user keys and press them.*
○*Check that the engine can be started using all registered user keys.*

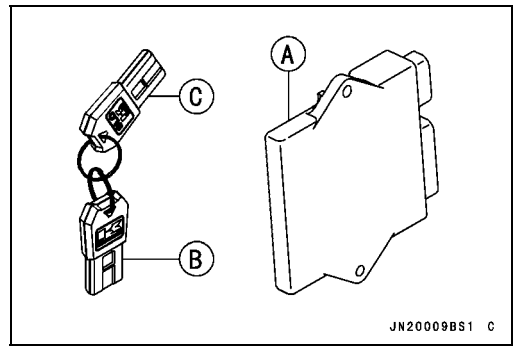
Case 3: When the following both keys are faulty or lost.

FPO Key (Full Power Operation Mode: orange-colored)
SLO Key (Smart Learning Operation Mode: yellow-colored and marked SLO)
If they are required, the following are necessary.

NOTE

○*The ECU must be replaced with a new one because the registration mode can not start in the state with no key.*

● Prepare a new ECU [A], new FPO key [B] and new SLO keys [C].



NOTE

○*The key registration unit is not required.*
○*The key registration process is same as the electric control unit replacement.*

Case 4: When replacing the immobilizer amplifier (ignition switch).

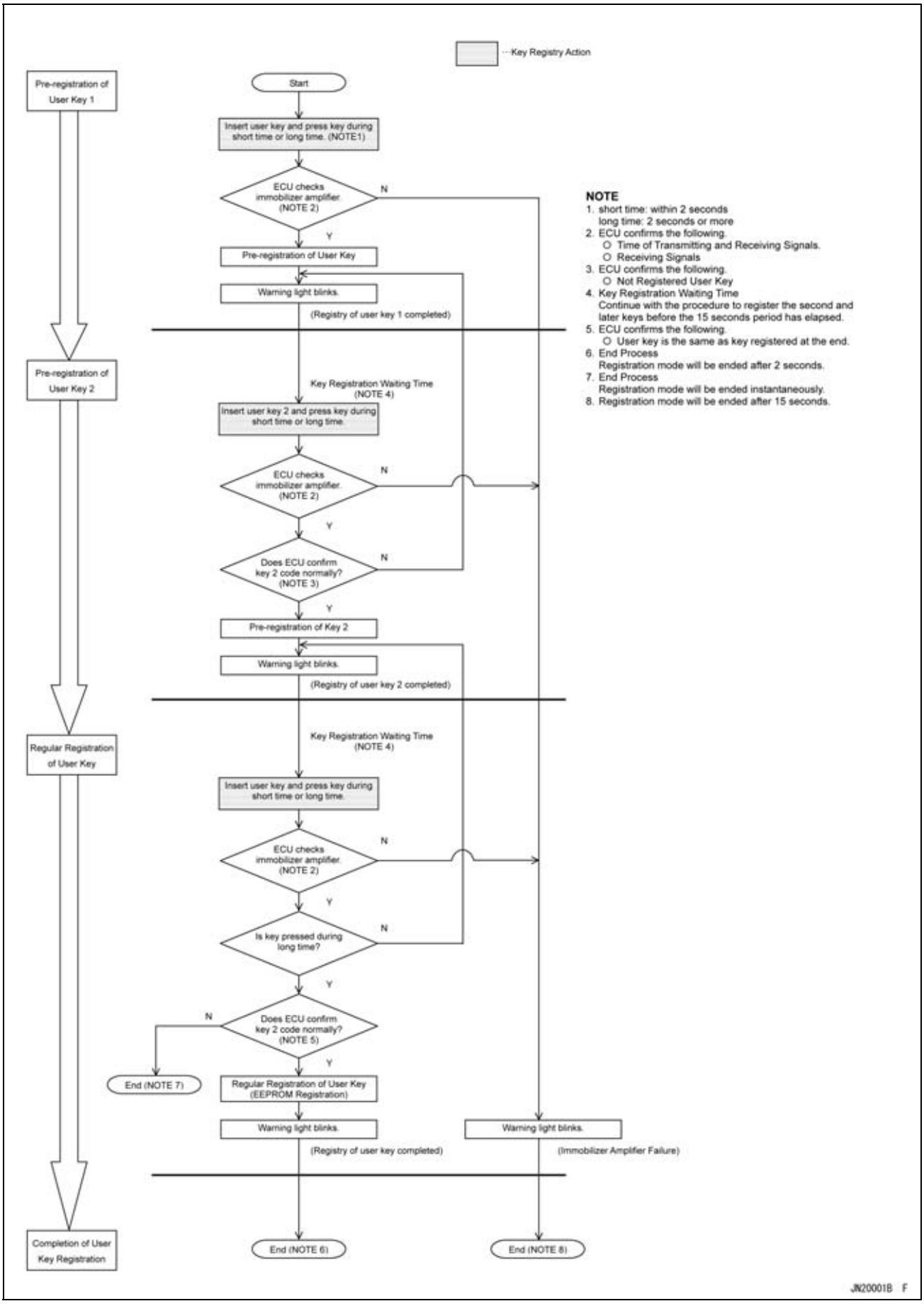
● Prepare a new immobilizer amplifier (ignition switch).
● Refer to the Immobilizer System Parts Replacement.

NOTE

○*No key registration unit is required.*

Immobilizer System

All Keys Initial Registration Flow Chart

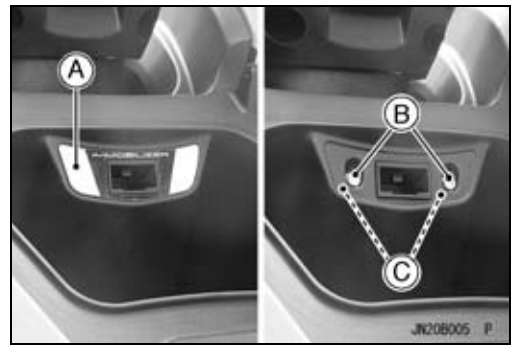

Key Registry Action
Pre-registration of User Key 1
Start
Insert user key and press key during short time or long time. (NOTE1)
ECU checks immobilizer amplifier. (NOTE 2)
N
Y
Pre-registration of User Key
Warning light blinks.
(Registry of user key 1 completed)
Pre-registration of User Key 2
Key Registration Waiting Time (NOTE 4)
Insert user key 2 and press key during short time or long time.
ECU checks immobilizer amplifier. (NOTE 2)
N
Y
Does ECU confirm key 2 code normally? (NOTE 3)
N
Y
Pre-registration of Key 2
Warning light blinks.
(Registry of user key 2 completed)
Regular Registration of User Key
Key Registration Waiting Time (NOTE 4)
Insert user key and press key during short time or long time.
ECU checks immobilizer amplifier. (NOTE 2)
N
Y
Is key pressed during long time?
N
Y
Does ECU confirm key 2 code normally? (NOTE 5)
N
Y
End (NOTE 7)
Regular Registration of User Key (EEPROM Registration)
Warning light blinks.
(Registry of user key completed)
Warning light blinks.
(Immobilizer Amplifier Failure)
Completion of User Key Registration
End (NOTE 6)
End (NOTE 8)
NOTE
1. short time: within 2 seconds
long time: 2 seconds or more
2. ECU confirms the following.
O Time of Transmitting and Receiving Signals.
O Receiving Signals
3. ECU confirms the following.
O Not Registered User Key
4. Key Registration Waiting Time
Continue with the procedure to register the second and later keys before the 15 seconds period has elapsed.
5. ECU confirms the following.
O User key is the same as key registered at the end.
6. End Process
Registration mode will be ended after 2 seconds.
7. End Process
Registration mode will be ended instantaneously.
8. Registration mode will be ended after 15 seconds.
JN20001B F

Immobilizer System

Immobilizer System Parts Replacement

Immobilizer Amplifier (Ignition Switch) Replacement

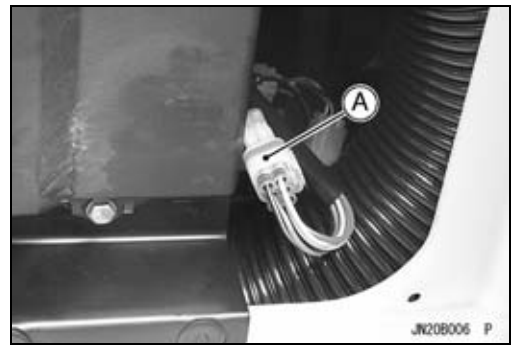
- Move the handlebar to full forward position.
- Remove the center storage lid (see Center Storage Lid Removal/Installation in the Hull/Engine Hood chapter).
- Remove the seal [A] from the steering cover.
- Unscrew the immobilizer amplifier (ignition switch) mounting bolts [B] and washers.



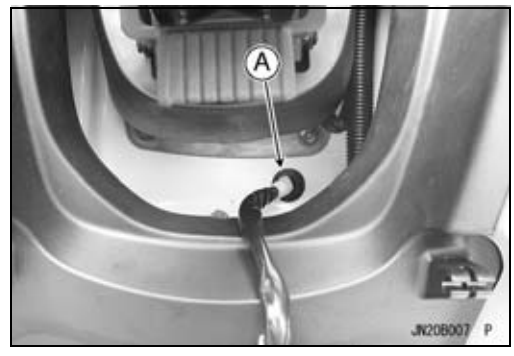
NOTE

○*Hold the clip nuts [C] on the immobilizer amplifier (ignition switch).*

- Open the front storage compartment cover.
- Remove the front access cover (see Front Access Cover Removal/Installation in the Hull/Engine Hood chapter).
- Disconnect the immobilizer amplifier (ignition switch) lead connector [A].



- Remove the grommet [A] from the immobilizer amplifier (ignition switch) lead.
- Pull out the immobilizer amplifier (ignition switch) from the space of steering.



- Install the new immobilizer amplifier (ignition switch).

NOTE

○*Route the immobilizer amplifier (ignition switch) lead not to interfere with the steering cable and shaft.*

○*Install the immobilizer amplifier (ignition switch) so that the letters of the switch faces upward.*

- Replace the seal with a new one.

ECU (Electric Control Unit) Replacement

- Refer to ECU Removal in the Fuel System (DFI) chapter.

Immobilizer System

Immobilizer Relational Parts Replacement Chart

		Failed or Lost Part			
		FPO Key (Orange)	SLO Key (Yellow)	Immobilizer Amplifier	ECU
*	FPO Key (Orange)	●			
	SLO Key (Yellow)		●		
	Immobilizer Amplifier			●	
	ECU				●

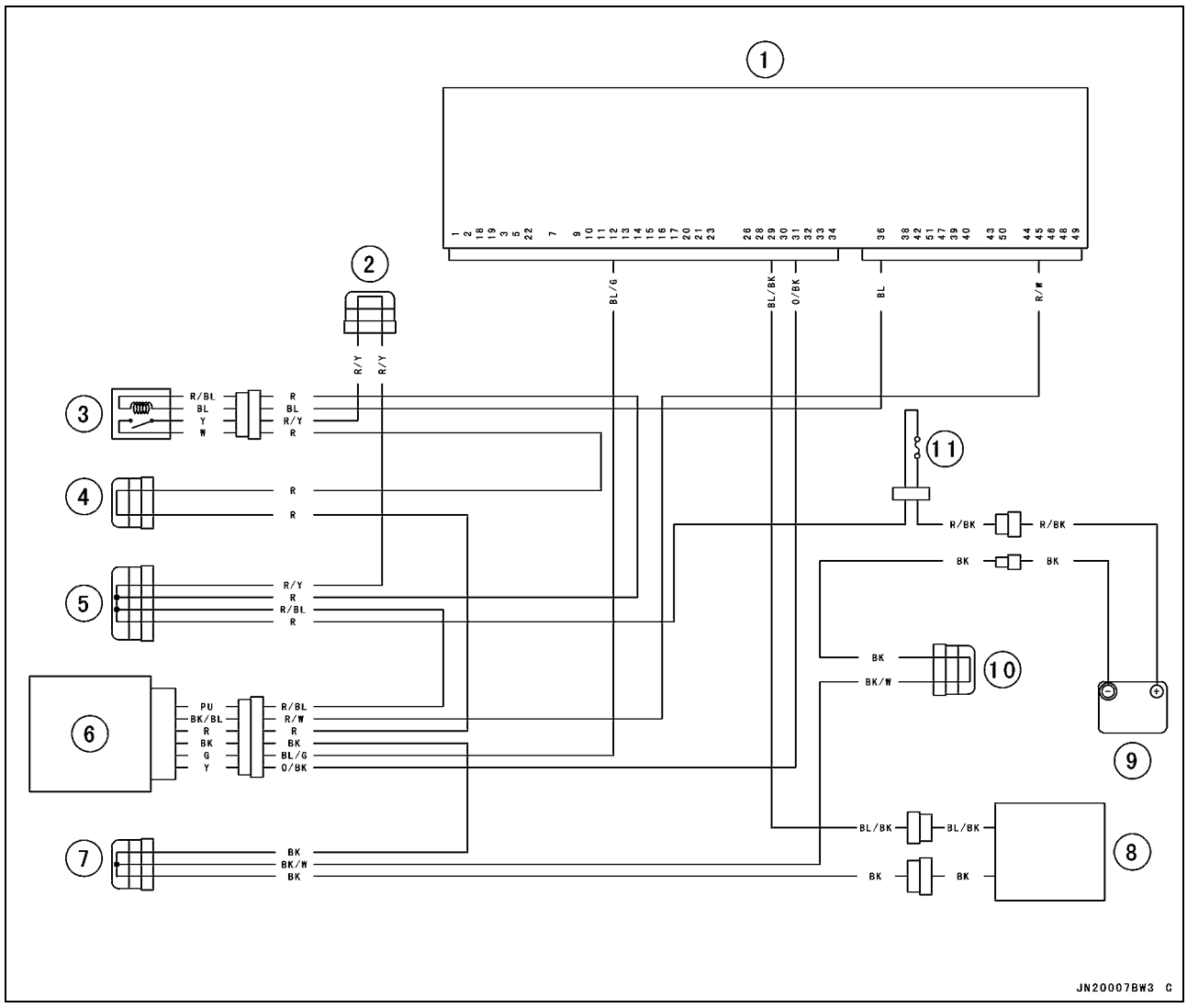
*	Replacement Part
●	Main Replacement Part

Immobilizer System Inspection

- Refer to the Immobilizer Amplifier and Key Collation Error section in Fuel System (DFI) chapter (see Immobilizer Amplifier and Key Collation Error section in Fuel System (DFI) chapter).

Immobilizer System

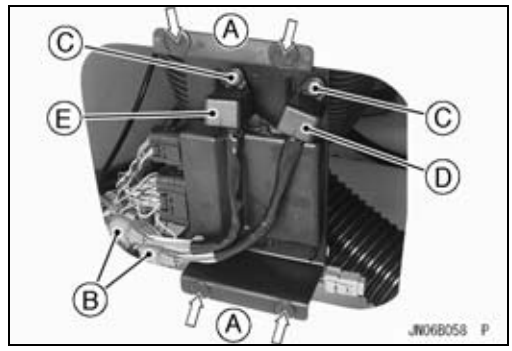
Immobilizer System Circuit



1. ECU
2. Joint Connector 8 (Vcc)
3. System Relay
4. Joint Connector 2
5. Joint Connector 1
6. Ignition Switch (Immobilizer Amplifier)
7. Joint Connector 15 (Ground)
8. Multifunction Meter
9. Battery
10. Joint Connector 12 (Ground)
11. Main Fuse 20 A

Relay Assembly

Relay Assembly Removal



- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Remove the front access cover (see Front Access Cover Removal/Installation in the Hull/Engine Hood chapter).
- Push in the pins [A] and remove the bracket.
- Remove:
  Relay Assembly Connectors [B]
  Bolt [C]
  Main (ECU) Relay [D]
  Fuel Pump System Relay [E]

Relay Assembly Installation

- Apply a non-permanent locking agent to the relay assembly mounting bolts and tighten it securely.
- Install the bracket with the rivets (see Front Access Cover Removal/Installation in the Hull/Engine Hood chapter).
- Route the relay assembly leads correctly (see Cable, Wire and Harness Routing in Appendix chapter).

Relay Assembly Inspection

- Remove the relay assembly.
- Check conductivity of the following numbered terminals by connecting the hand tester and one 12 V battery to the relay assembly as shown.

★If the tester does not read as specified, replace the relay assembly.

Relay Assembly

Relay Assembly Circuit Inspection (with the battery disconnected)

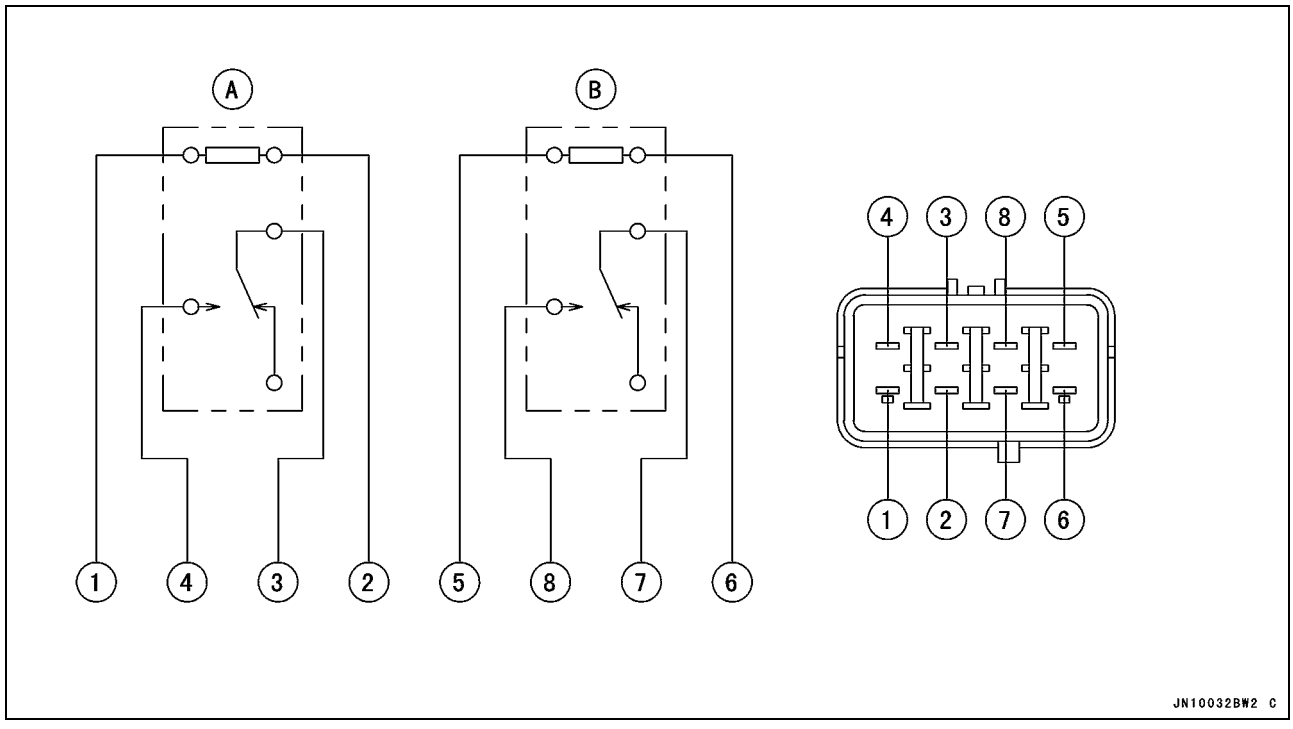
	Tester Connection	Tester Reading (Ω)
Main ECU Relay [A] Fuel Pump Relay [A]	3-4	∞
	1-2	Not ∞*
System Relay [B]	7-8	∞
	5-6	Not ∞*

(*): The actual reading varies with the hand tester used.

Relay Assembly Circuit Inspection (with the battery connected)

	Battery Connection (+) (–)	Tester Connection	Tester Reading (Ω)
Main (ECU) Relay [A] Fuel Pump Relay [A]	1-2	3-4	0
System Relay [B]	5-6	7-8	0

(+): Apply positive lead.
(–): Apply negative lead.



Switches

Switch Inspection

- Using a hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).

○For the switch housing and the ignition switch, refer to the tables in the Wiring Diagram.

★If the switch has an open or short, repair it or replace it with a new one.

Special Tool - Hand Tester: 57001-1394

Start Switch

	Y/R	Y/R
PUSH	○———	———○

Stop Switch

	BK	W
FREE		
PUSH	○———	———○

Tether Switch

TETHER CORD	BK	W	R/PU	Y/R
SET			○———	———○
PULL	○———	———○		

Engine Oil Pressure Switch Connections*

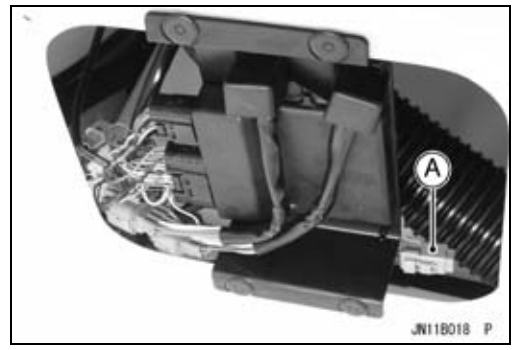
	SW. Terminal	⏚
When engine is stopped	○———	———○
When engine is running		

*: Engine lubrication system is in good condition

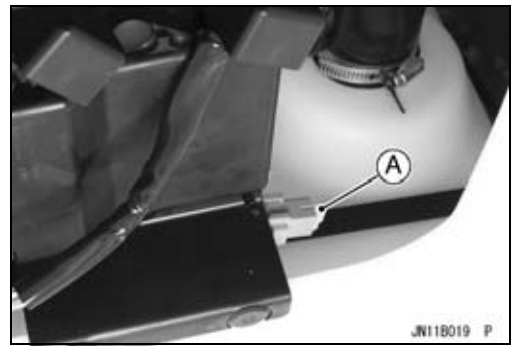
Fuse

Inspection

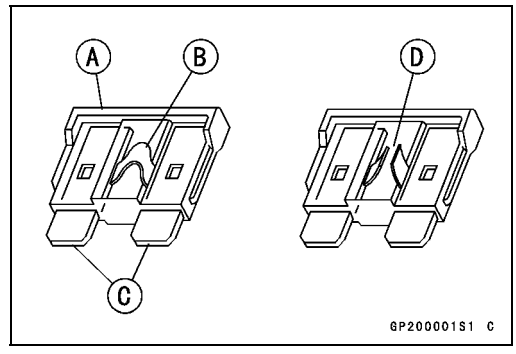
● Remove:
Seat
Fuse Case [A]



● Take out the fuse [A].



● Inspect the fuse element.
★If it blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.
Housing [A]
Fuse Element [B]
Terminals [C]
Blown Element [D]



CAUTION

When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.

Storage

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Preparation for Storage 15-2
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- Lubrication 15-4
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Removal from Storage 15-6
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- General Inspection 15-6
- Fuel System 15-6
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- Test Run 15-7

Preparation for Storage

During the winter, or whenever the watercraft will not be in use for a long period of time, proper storage is essential. It consists of checking and replacing missing or worn parts; lubricating parts to ensure that they do not become rusted; and, in general, preparing the watercraft so that when the time comes to use it again, it will be in top condition.

NOTE

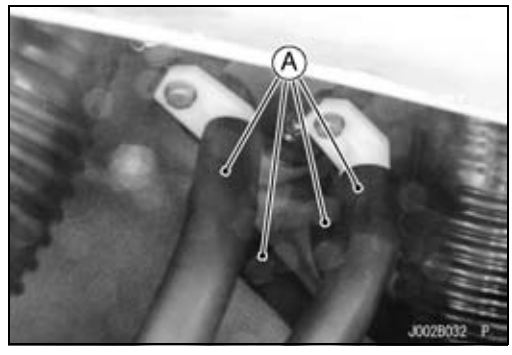
○*Personal watercraft is not meant to be left in the water for extended periods. Continuous exposure to water over a long period of time will cause the hull paint to bubble and peel. It also causes electrolytic erosion of the metal parts of the pump, decreasing its service life. Larger boats which are left in the water must be hauled out periodically, so the bottom of the hull can be scraped and repainted with anti-fouling paint. They also usually have a sacrificial anode to reduce electrolytic erosion of metal parts in contact with the water.*

Cooling System

- Clean the cooling system (see Cooling System Flushing in the Periodic Maintenance chapter).

Bilge System

- Clean the bilge system (see the Periodic Maintenance chapter). Before reconnecting the hoses to the plastic breather fitting, blow air through both hoses [A] to force all water out of the bilge system.



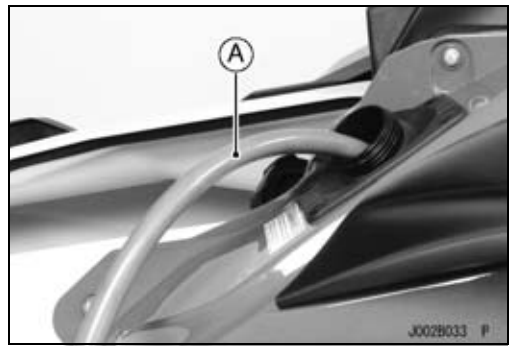
Engine Oil

- Change the engine oil (see Engine Lubrication System in Periodic Maintenance chapter).

Fuel System

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.



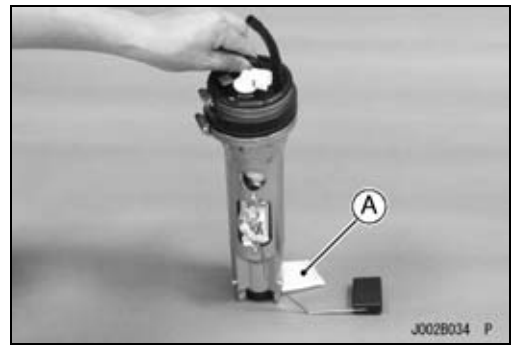
- Drain the fuel tank. This should be done with a siphon or pump.

  [A] Siphon Hose

NOTE

○*Lift the stern upward a little so that fuel and water in the bottom of the fuel tank may flow toward the fuel filter to completely drain the fuel tank.*

Preparation for Storage



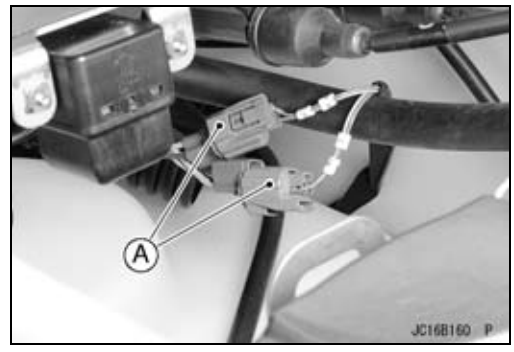
- Remove the fuel pump (see the Fuel System chapter).
- Clean the fuel pump screen [A] (see Fuel System in Periodic Maintenance chapter).
- Refill the fuel tank with fresh fuel approximately 10 L (2.6 gal U.S.).
- Turn the ignition switch on.
- Push the lanyard key under the stop button, and start the engine and run it in 15 second periods until all fuel in the fuel system is with fresh fuel. Wait 5 minutes between 15 seconds running periods.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds at a time or severe engine and exhaust system damage will occur.

- Pull the lanyard key off the stop button and turn the ignition switch off.
- Drain the fuel tank.
- Leave the fuel filler cap loose to prevent condensation in the tank.

Engine



- Remove the seat (see Seat Removal in the Hull/Engine Hood chapter).
- Disconnect both two connection on the ignition coil primary lead connectors [A].
- Remove the spark plugs (see Electrical System in Periodic Maintenance chapter).
- Spray fogging oil directly into each cylinder.
- Turn the ignition switch on.
- Push the lanyard key under the stop button. Turn the engine over several times with the start button to coat the cylinder walls with oil.

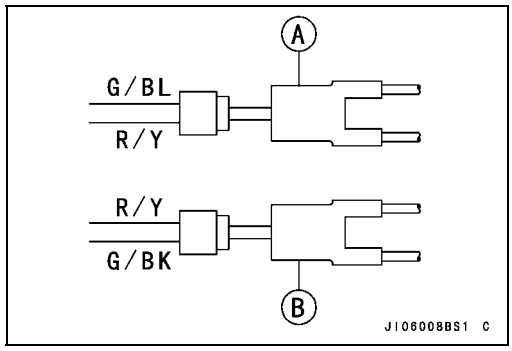
⚠ WARNING

Do not lean over the engine when performing this procedure. An air/oil mist may be forcibly ejected from the spark plug holes and could get into your eyes. If you do get some in your eyes, wash your eyes immediately with liberal amounts of clean, fresh water. Consult a physician as soon as possible.

- Pull the lanyard key off the stop button and turn the ignition switch off.
- Spray the spark plugs with fogging oil, and reinstall the spark plugs and caps (see Electrical System in Periodic Maintenance chapter).

Preparation for Storage

- Reconnect the primary ignition coil lead connectors, noting the #1,#4 [A] and the #2, #3 [B] coil connectors. The #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.



NOTE

○*The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).*

Battery

- Give a refresh charge before you store the watercraft and store it with the negative lead removed. Give a refresh charge once a month during storage.
- Remove the battery (see Electrical System in Periodic Maintenance chapter).
- Clean the exterior with a solution of baking soda and water (one heaping tablespoon of baking soda in one cup of water). Rinse thoroughly with water.

CAUTION
Do not allow any soda solution to enter the battery.

- Coat both battery terminals with grease.
- Store the battery in a cool, dry place. Do not expose it to freezing temperatures.

Engine Mounting Bolts

- Torque all engine mounting bolts (see Engine Removal/Installation chapter).

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

Lubrication

- Carry out all recommended lubrication procedures (see Lubrication in Periodic Maintenance chapter).

Supercharger

- Check the supercharger gear oil level (see Supercharger Gear Oil Level Inspection in the Periodic Maintenance chapter).
- Visually inspect the supercharger drive belt for wear/damage and check the belt tension (see Supercharger Drive Belt for Wear/Damage and Belt Tension Inspection in the Periodic Maintenance chapter).

Preparation for Storage

General

- Wash the engine compartment with fresh water and remove the drain screw in the stern to drain the water. Wipe up any water left in the compartment.

CAUTION
Use only a mild detergent in water to wash the hull. Harsh solvents may attack the surface or smear the colors.

- Apply a good grade of wax to all exterior hull surfaces.
- Lightly spray all exposed metal parts with a penetrating rust inhibitor.
- Remove the seat, or block the seat up with 10 mm (0.39 in.) spacers to insure adequate ventilation, and prevent corrosion.
- Cover the watercraft and store it in a clean, dry place.

Removal from Storage

Lubrication

- Carry out all recommended lubrication procedures (see the Periodic Maintenance chapter).

General Inspection

- Check for binding or sticking throttle, steering or shift mechanism. The throttle lever must return fully when released.
- Clean and gap spark plugs (see Electrical System in Periodic Maintenance chapter).
- Check all rubber hoses for weathering a cracking, or looseness.
- Check that the drain screw in the stern is securely tightened.
- Check the fire extinguisher for a full charge.
- Check the battery, charge if necessary, and clean the terminals. Install the battery (see Battery Installation in Electrical System chapter).

Fuel System

- Check and clean or replace the fuel pump screens as necessary (see Fuel System in Periodic Maintenance chapter).

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. Pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from source of flame or spark; this includes any appliance with a pilot light.

- After refueling and before starting the engine, tilt the seat to the rear for several minutes to ventilate the engine compartment.

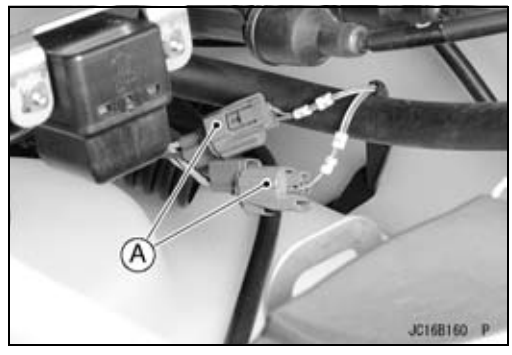
⚠ WARNING

A concentration of gasoline fumes in the engine compartment can cause a fire or explosion.

- Check for fuel leaks. Repair if necessary.
- Check the engine oil level. Fill the oil with the specified oil.

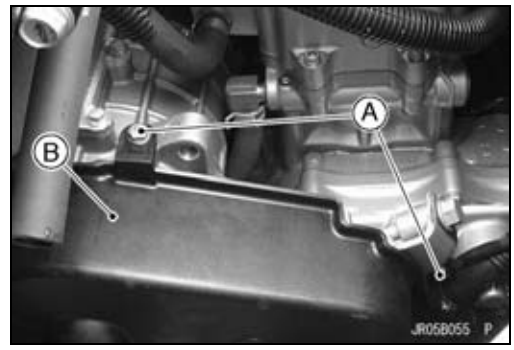
Supercharger

- Disconnect both two connection on ignition oil primary lead connectors [A].



Removal from Storage

- Remove the belt cover bolts [A] and belt cover [B] (see Supercharger Drive Belt for Wear/Damage and Belt Tension Inspection in the Periodic Maintenance chapter).



- Crank the engine for several times and check that the engine pulley and supercharger pulley rotate with the drive belt.

★If the drive belt slips or the supercharger pulley does not rotate, check the following.
Belt Tension (see Supercharger Drive Belt for Wear/Damage and Belt Tension Inspection in the Periodic Maintenance chapter).
Supercharger (see Supercharger section in the Periodic Maintenance chapter).

Test Run

⚠ WARNING

Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas. Breathing exhaust gas leads to carbon monoxide poisoning, asphyxiation, and death.

- Start the engine and run it only for 15 seconds. Check for fuel, oil and exhaust leaks. Any leaks must be repaired.

CAUTION

Do not run the engine without cooling water supply for more than 15 seconds at a time or severe engine and exhaust system damage will occur.

- Install the seat making sure it is locked.

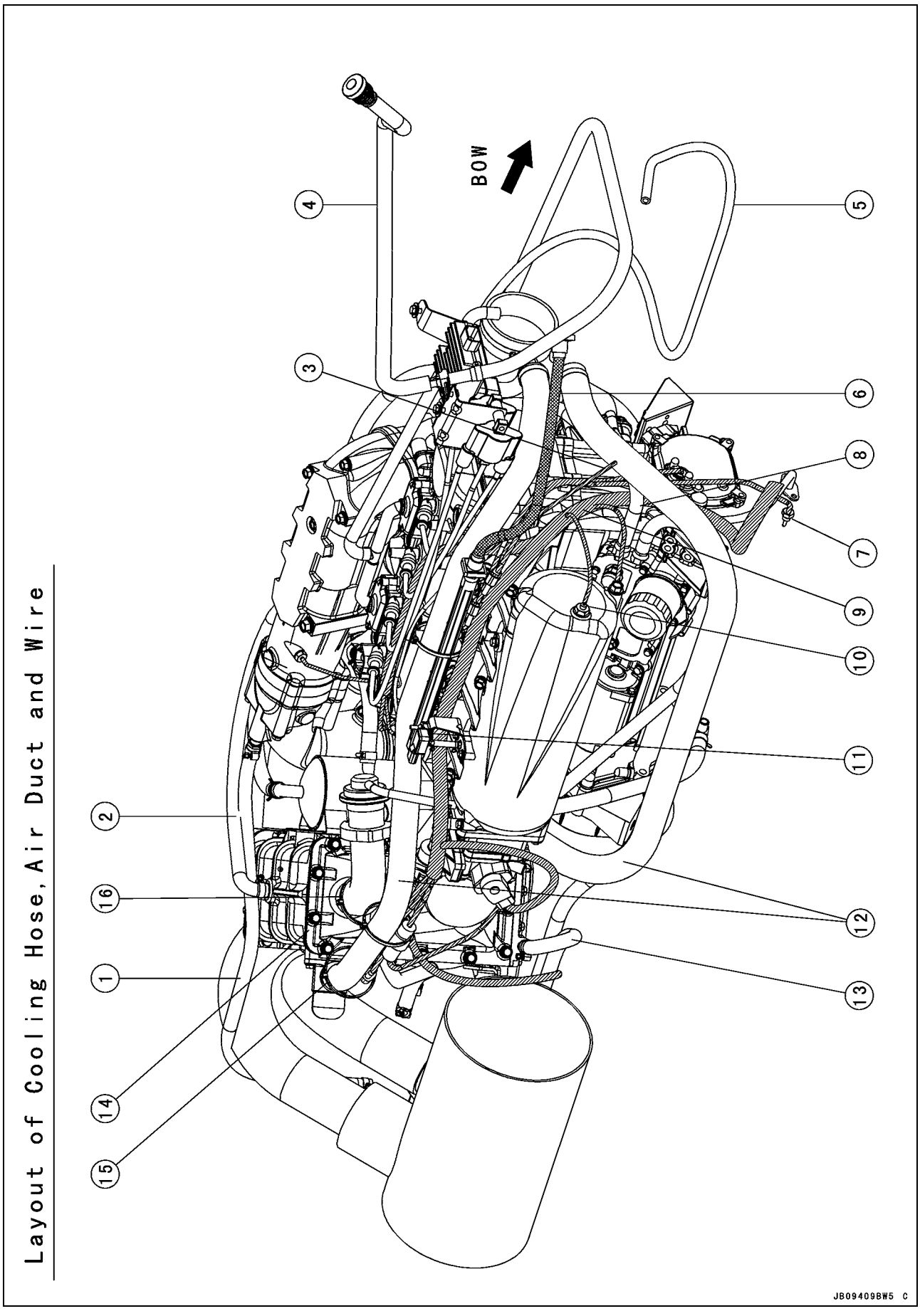
Appendix

Table of Contents

Cable, Wire and Hose Routing 16-2
Troubleshooting Guide 16-56

Cable, Wire and Hose Routing

JT1500B7F

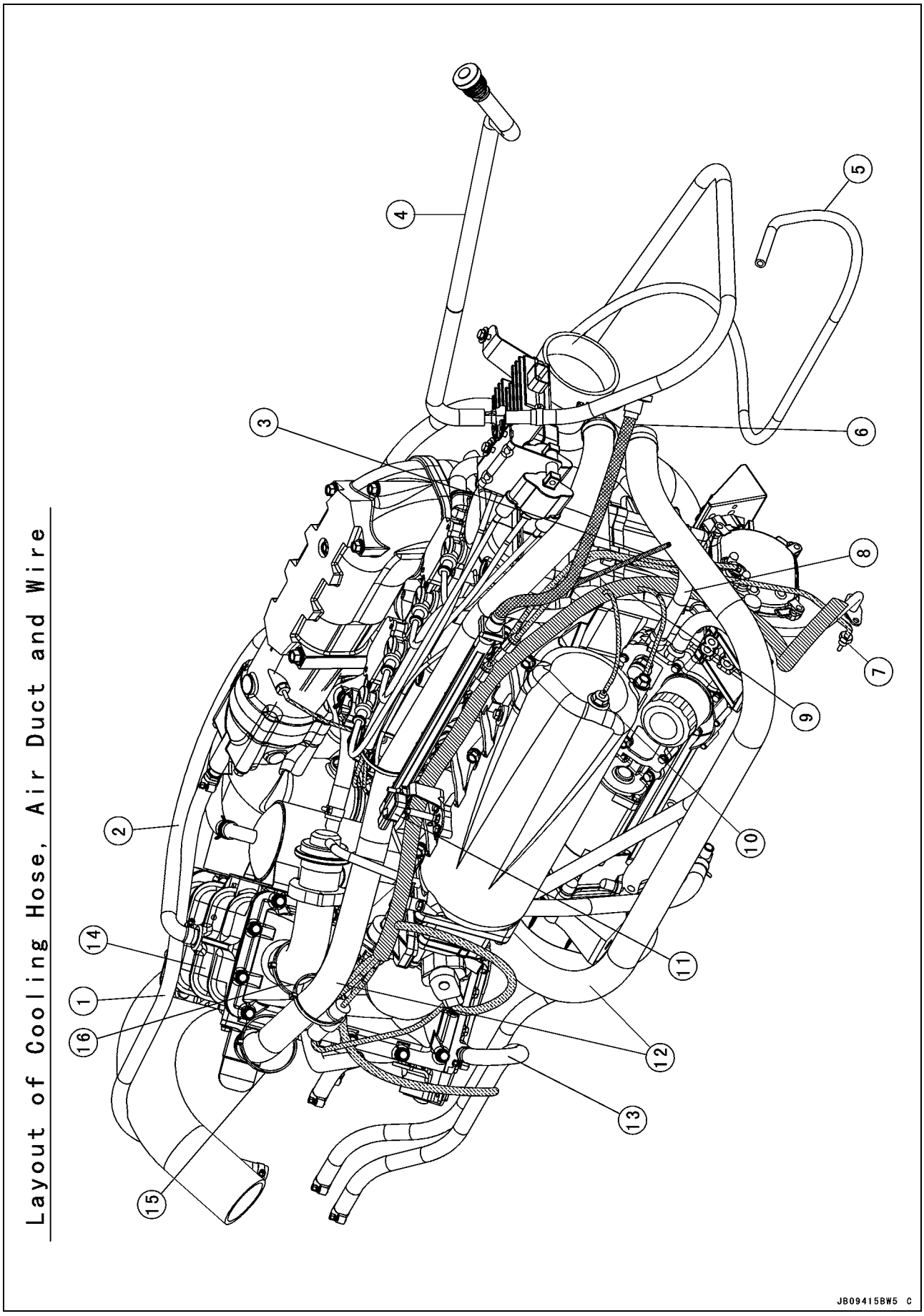


Cable, Wire and Hose Routing

1. Cooling Hose (Muffler Body ~ Hull)
2. Flushing Hose (Exhaust Manifold ~ Intercooler)
3. Throttle Cable
4. Flushing Hose (Flushing Fitting ~ Exhaust Manifold)
5. Bypass Outlet Hose
6. Fuel Hose
7. Oil Temperature Sensor
8. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
9. Main Harness: Run the main harness between the No.8 cooling hose and the engine.
10. Air Temperature Sensor
11. Inlet Air Pressure Sensor
12. Air Bypass Duct
13. Cooling Hose (Pump ~ Intercooler)
14. Intercooler
15. Fix the air bypass duct and inlet air temperature sensor lead with the band.
16. Fix the bypass tube and cooling and cooling hose with the band.

Cable, Wire and Hose Routing

JT1500B8F

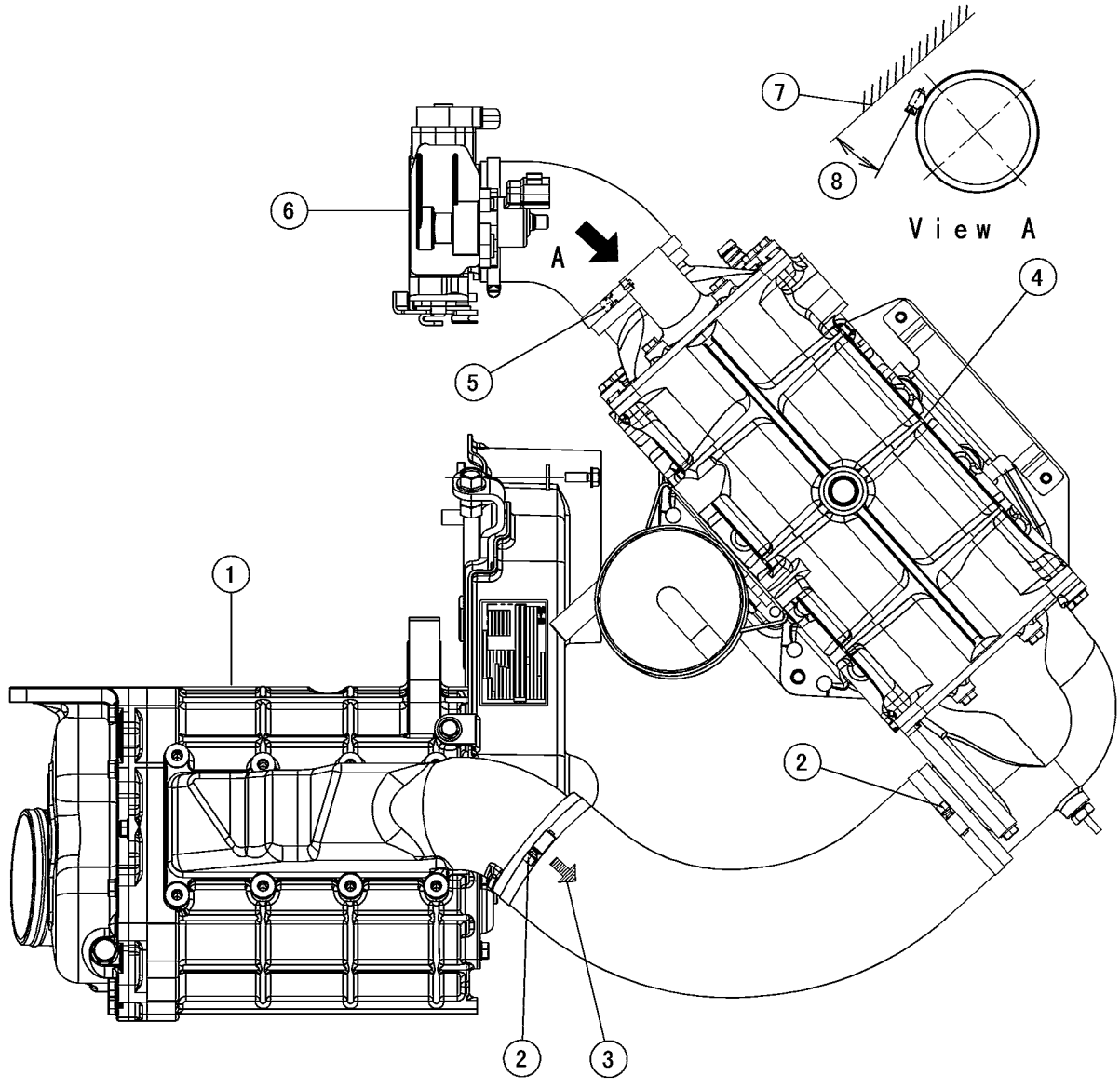


Cable, Wire and Hose Routing

1. Cooling Hose (Muffler Body ~ Hull)
2. Flushing Hose (Exhaust Manifold ~ Intercooler)
3. Throttle Cable
4. Flushing Hose (Flushing Fitting ~ Exhaust Manifold)
5. Bypass Outlet Hose
6. Fuel Hose
7. Oil Temperature Sensor
8. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
9. Main Harness: Run the main harness between the No.8 cooling hose and the engine.
10. Air Temperature Sensor
11. Inlet Air Pressure Sensor
12. Air Bypass Duct
13. Cooling Hose (Pump ~ Intercooler)
14. Intercooler
15. Fix the air bypass duct and inlet air temperature sensor lead with the band.
16. Fix the bypass tube and cooling and cooling hose with the band.

Cable, Wire and Hose Routing

Intake Duct Routing

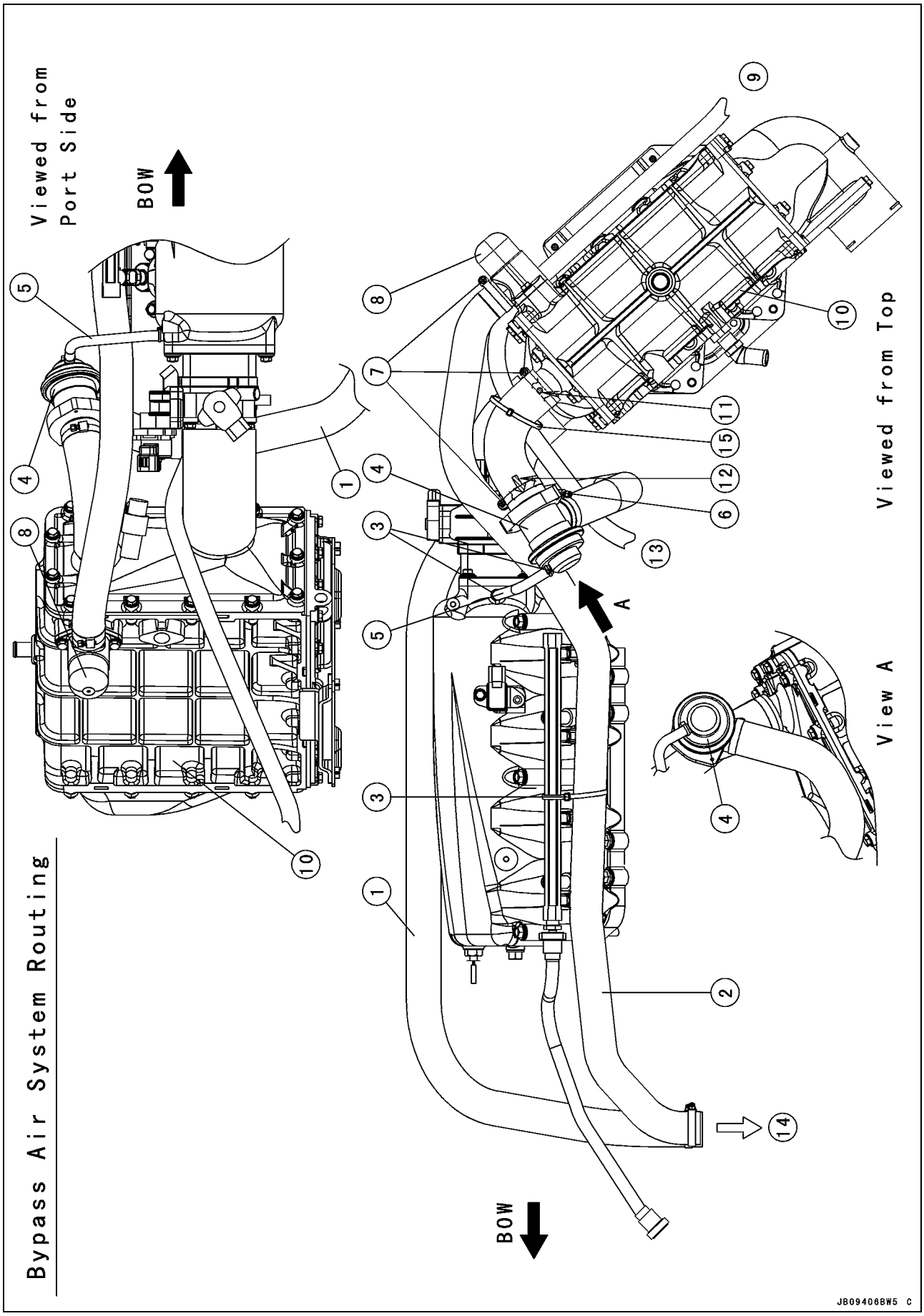


JB09407BW5 C

Cable, Wire and Hose Routing

1. Supercharger
2. Position the clamp screw head, as shown.
3. White Arrow Mark
4. Intercooler
5. Position the clamp screw head under the (Intercooler ~ Throttle Body) as shown.
6. Throttle Body
7. Horizontal Level
8. 20°

Cable, Wire and Hose Routing

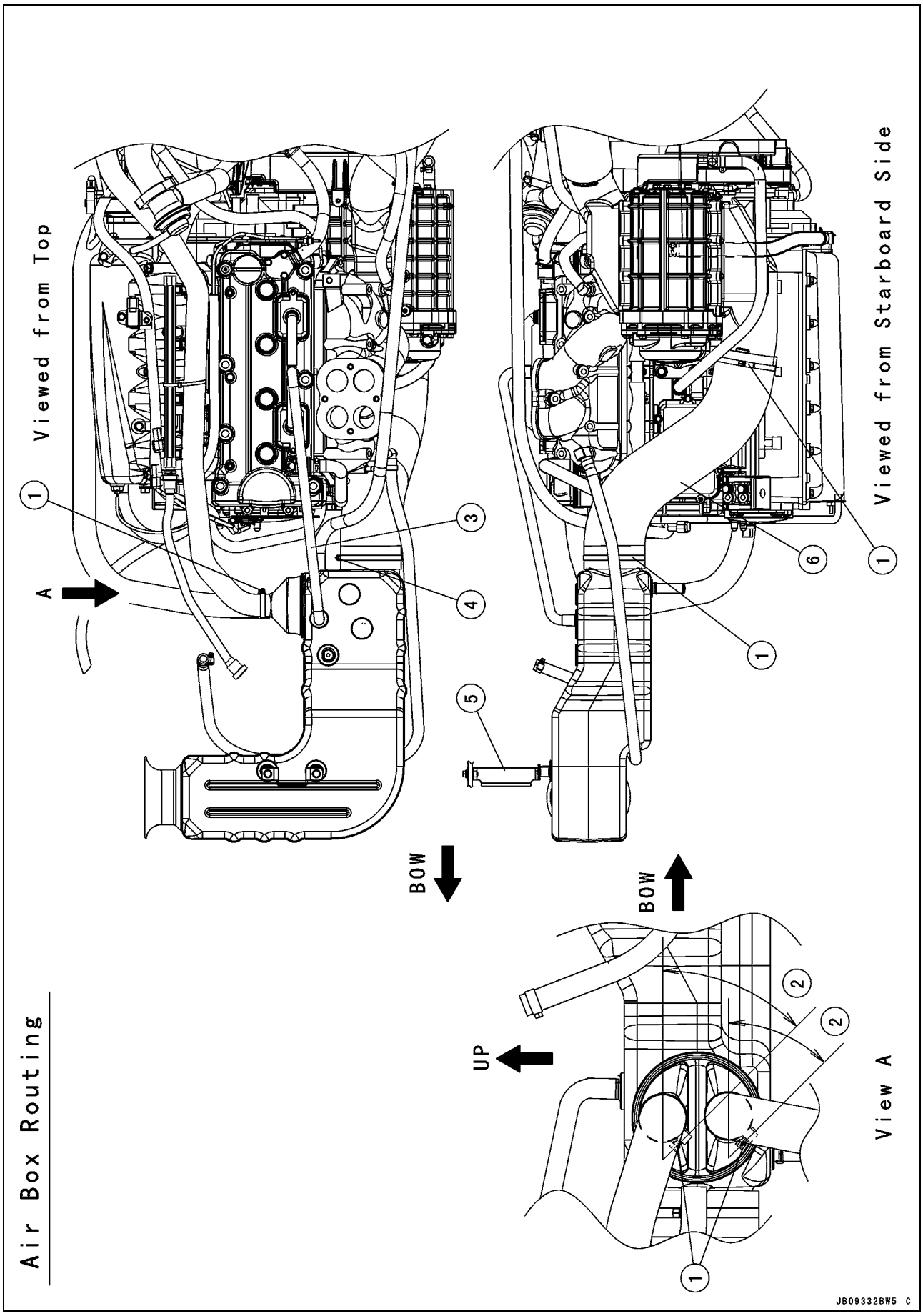


Cable, Wire and Hose Routing

1. Duct (Relief Valve ~ Air Box)
2. Duct (Blow off Valve ~ Air Box)
3. Bands
4. Relief Valve
5. Pulse Hose
6. Clamp
7. Clamps: Face up
8. Blow off Valve
9. from Hull (Cooling Hose)
10. Intercooler
11. White Mark
12. Arrow Mark
13. to Rear of Cylinder Head (Cooling Hose)
14. to Air Box
15. Fix the cooling hose (Pum ~ Cylinder Head) to the bypass tube with the band. Also fix it at the tube fitting on the intercooler.

Cable, Wire and Hose Routing

JT1500B7F

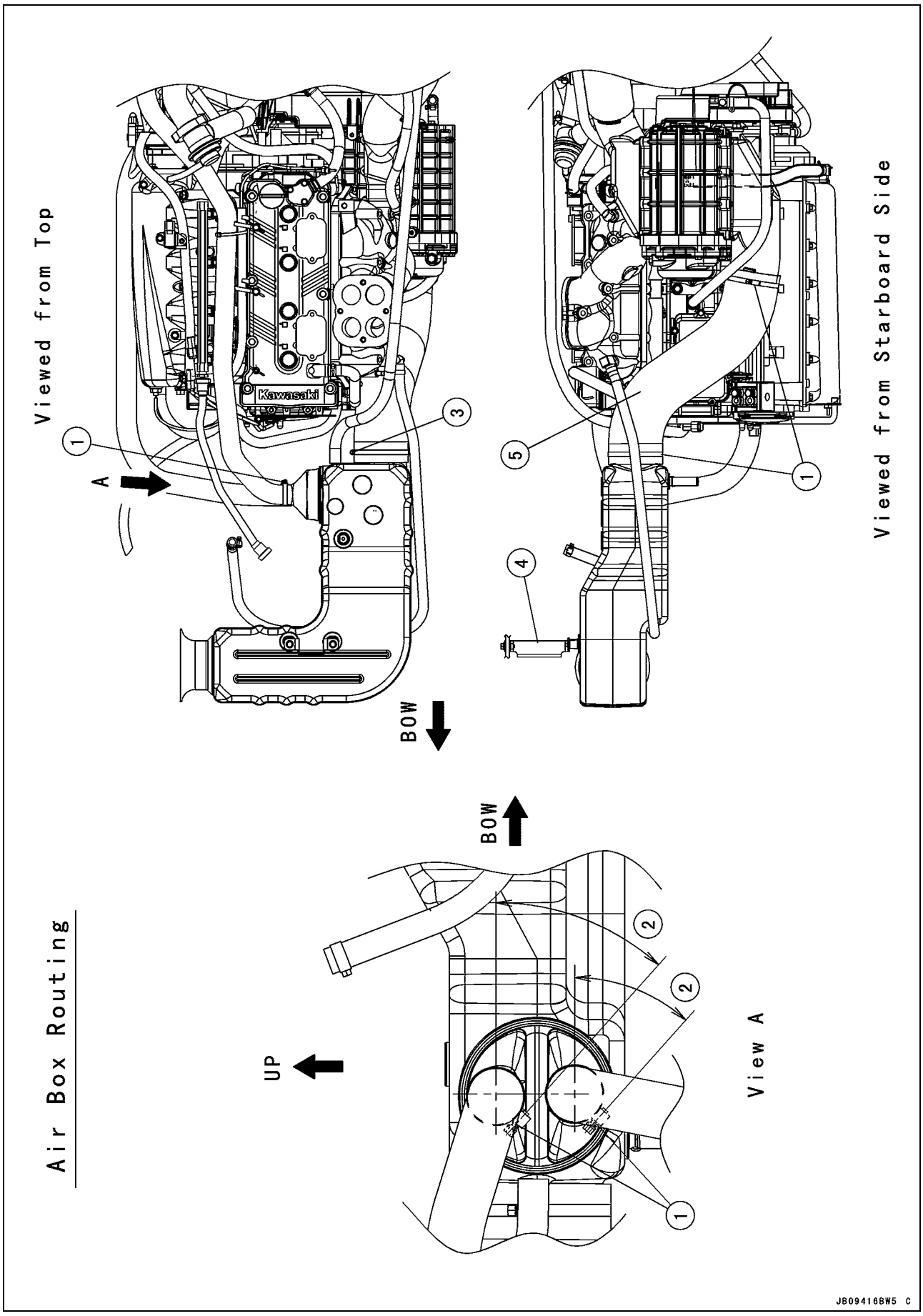


Cable, Wire and Hose Routing

1. Clamp
2. 45°
3. Air Suction Valve Hose
4. Face Up
5. Bracket
6. Duct

Cable, Wire and Hose Routing

JT1500B8F

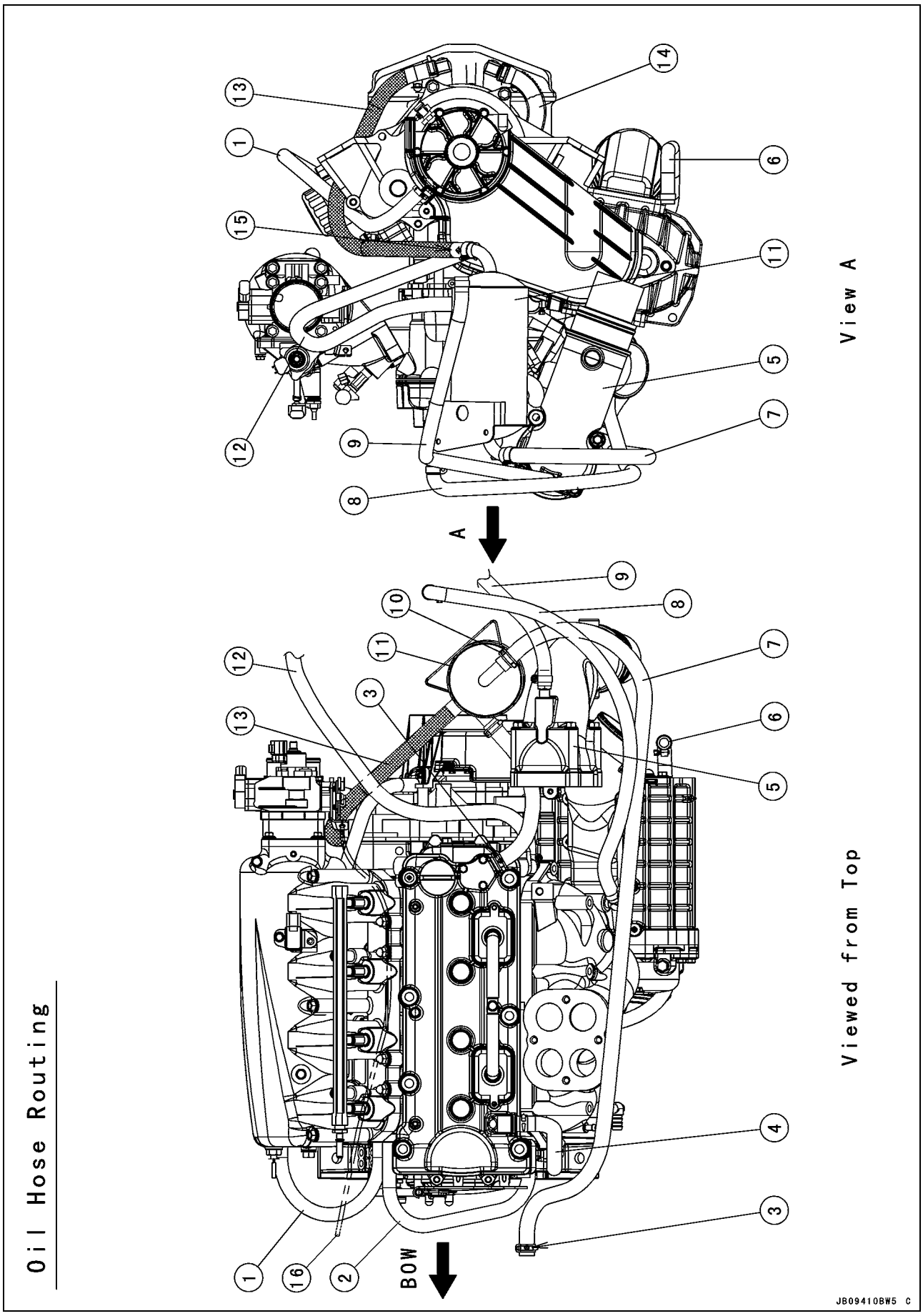


Cable, Wire and Hose Routing

1. Clamp
2. 45°
3. Face Up
4. Bracket
5. Duct

Cable, Wire and Hose Routing

JT1500B7F

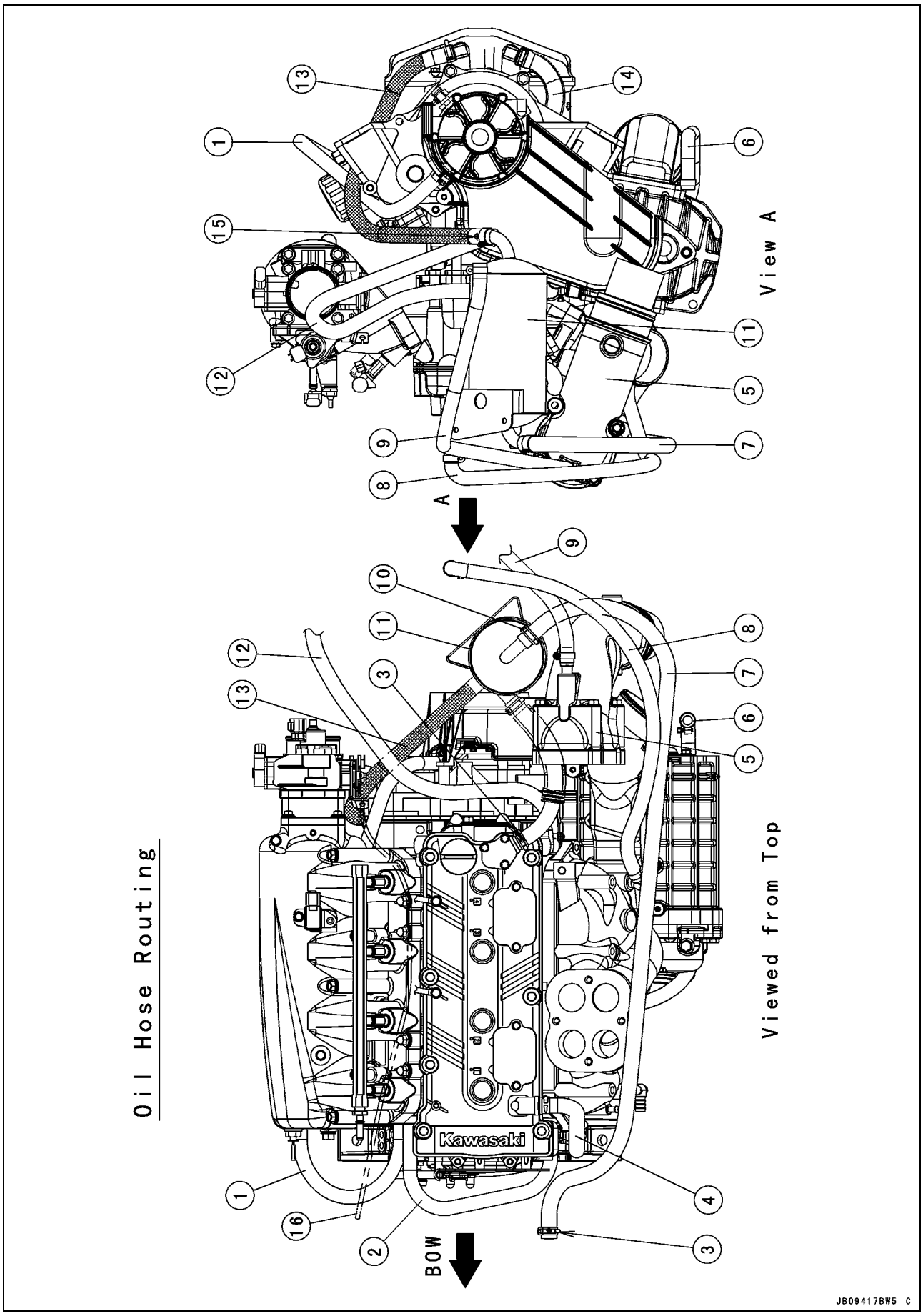


Cable, Wire and Hose Routing

1. Cooling Hose (Output Cover ~ Oil Cooler)
2. Cooling Hose (Oil Cover ~ Front of Cylinder Head)
3. White Mark
4. Breather Hose (Breather Case ~ Cylinder Head)
5. Muffler Body
6. Cooling Hose (Cylinder ~ Left Water Box Muffler)
7. Oil Separator Tank Hose (Tank ~ Air Box)
8. Flushing Hose (Exhaust Manifold ~ Intercooler)
9. Cooling Hose (Muffler Body ~ Hull)
10. Clamp
11. Oil Separator Tank
12. Cooling Hose (Pump ~ Rear of Cylinder Head)
13. Oil Separator Hose (Tank ~ Oil Pan)
14. Return Oil Hose (Cylinder ~ Oil Pan)
15. Arrow Mark
16. Throttle Cable

Cable, Wire and Hose Routing

JT1500B8F

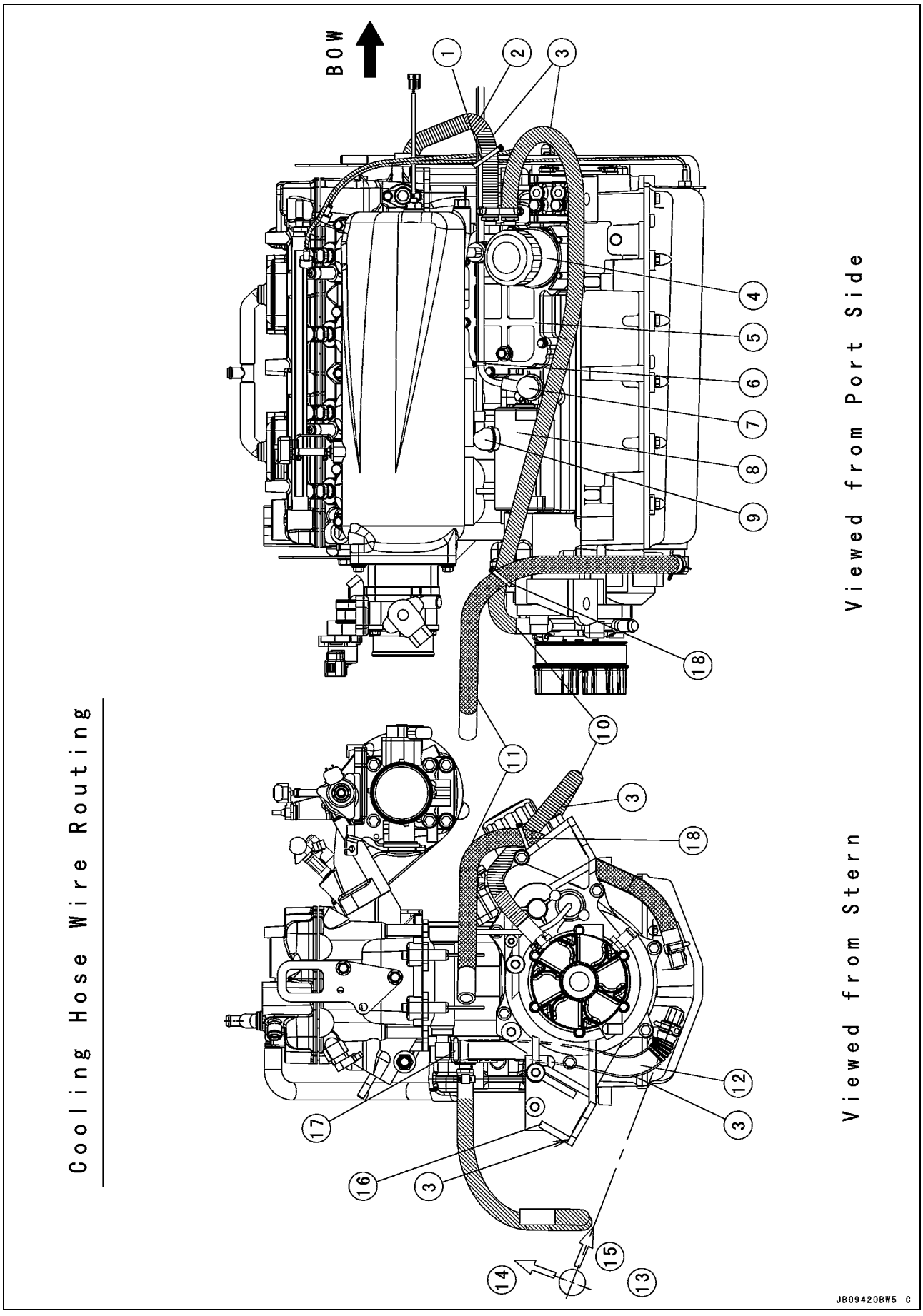


Cable, Wire and Hose Routing

1. Cooling Hose (Output Cover ~ Oil Cooler)
2. Cooling Hose (Oil Cover ~ Front of Cylinder Head)
3. White Mark
4. Breather Hose (Breather Case ~ Cylinder Head)
5. Muffler Body
6. Cooling Hose (Cylinder ~ Left Water Box Muffler)
7. Oil Separator Tank Hose (Tank ~ Air Box)
8. Flushing Hose (Exhaust Manifold ~ Intercooler)
9. Cooling Hose (Muffler Body ~ Hull)
10. Clamp
11. Oil Separator Tank
12. Cooling Hose (Pump ~ Rear of Cylinder Head)
13. Oil Separator Hose (Tank ~ Oil Pan)
14. Return Oil Hose (Cylinder ~ Oil Pan)
15. Arrow Mark
16. Throttle Cable

Cable, Wire and Hose Routing

JT1500B7F

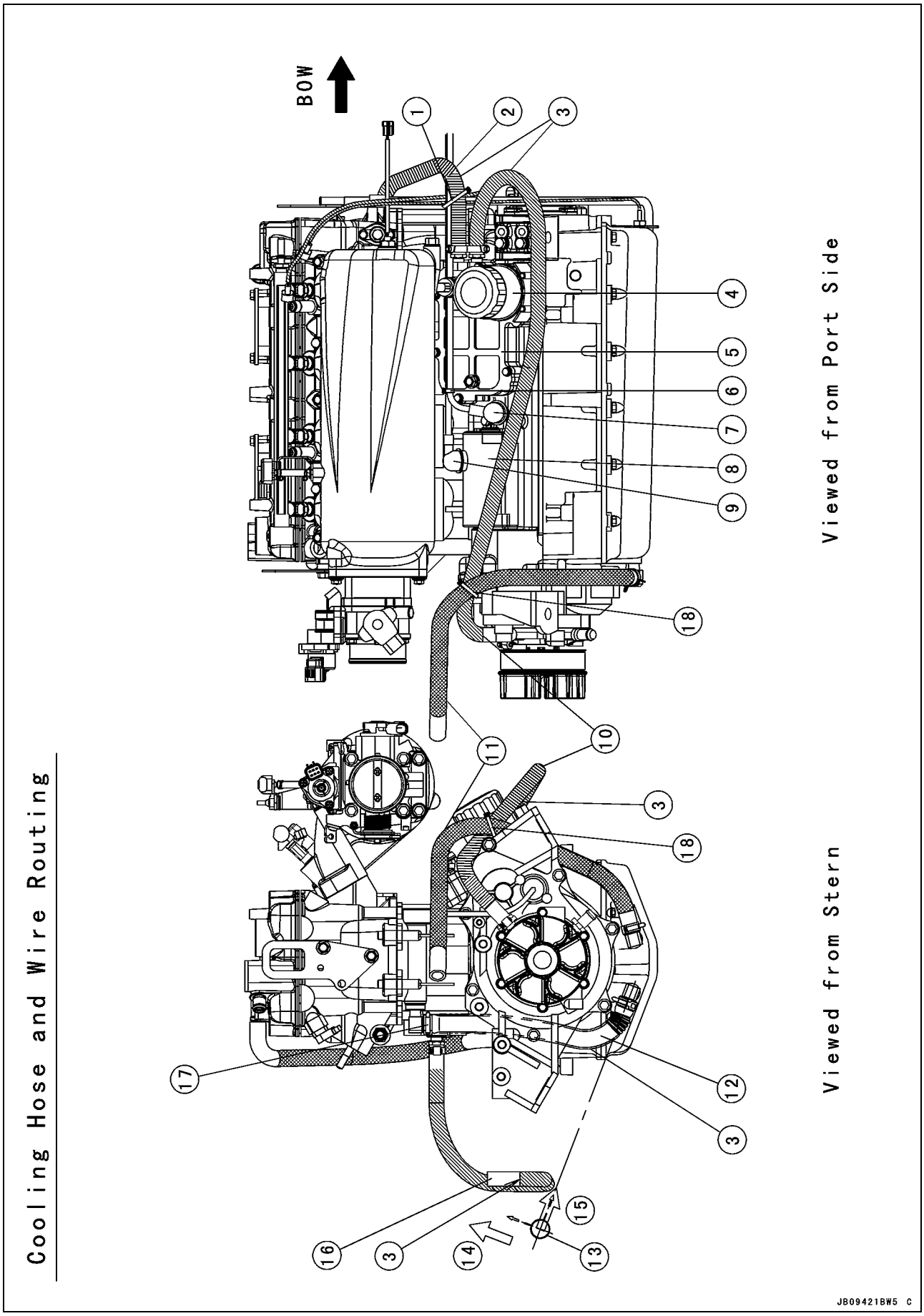


Cable, Wire and Hose Routing

1. Clamp the two cables, sensor leads and the cooling hose to the oil pipe with the band.
2. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
3. Protect Tube
4. Oil Filter
5. Oil Cooler
6. Clamp the starter motor and battery (–) cables, with the band.
7. Battery (−) Cable
8. Starter Motor
9. Starter Motor Cable
10. Cooling Hose (Output Cover ~ Oil Cooler)
11. Oil Separator Tank Hose (Tank ~ Oil Pan)
12. Return Oil Hose (Cylinder ~ Oil Pan)
13. Clamp
14. Front Pinch Head
15. Rear Pinch Head
16. Cooling Hose (Cylinder ~ Left Water Box Muffler)
17. Install the clamp so that its pinch head faces backward.
18. Clamp the cooling hose and oil separator tank hose, with the band.

Cable, Wire and Hose Routing

JT1500B8F

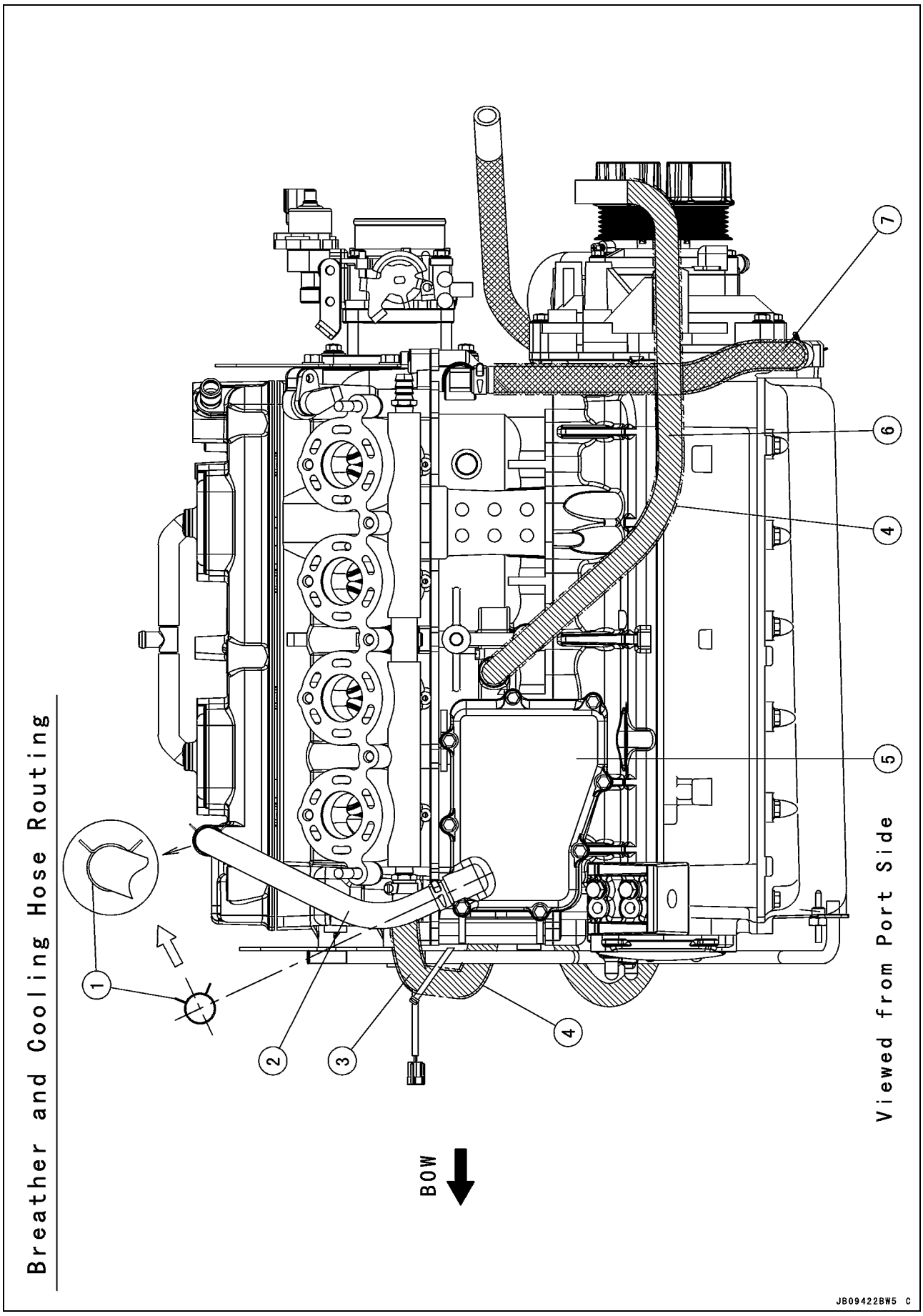


Cable, Wire and Hose Routing

1. Clamp the two cables, sensor leads and the cooling hose to the oil pipe with the band.
2. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
3. Protect Tube
4. Oil Filter
5. Oil Cooler
6. Clamp the starter motor and battery (–) cables, with the band.
7. Battery (−) Cable
8. Starter Motor
9. Starter Motor Cable
10. Cooling Hose (Output Cover ~ Oil Cooler)
11. Oil Separator Tank Hose (Tank ~ Oil Pan)
12. Return Oil Hose (Cylinder ~ Oil Pan)
13. Clamp
14. Front Pinch Head
15. Rear Pinch Head
16. Cooling Hose (Cylinder ~ Left Water Box Muffler)
17. Install the clamp so that its pinch head faces backward.
18. Clamp the cooling hose and oil separator tank hose, with the band.

Cable, Wire and Hose Routing

JT1500B7F

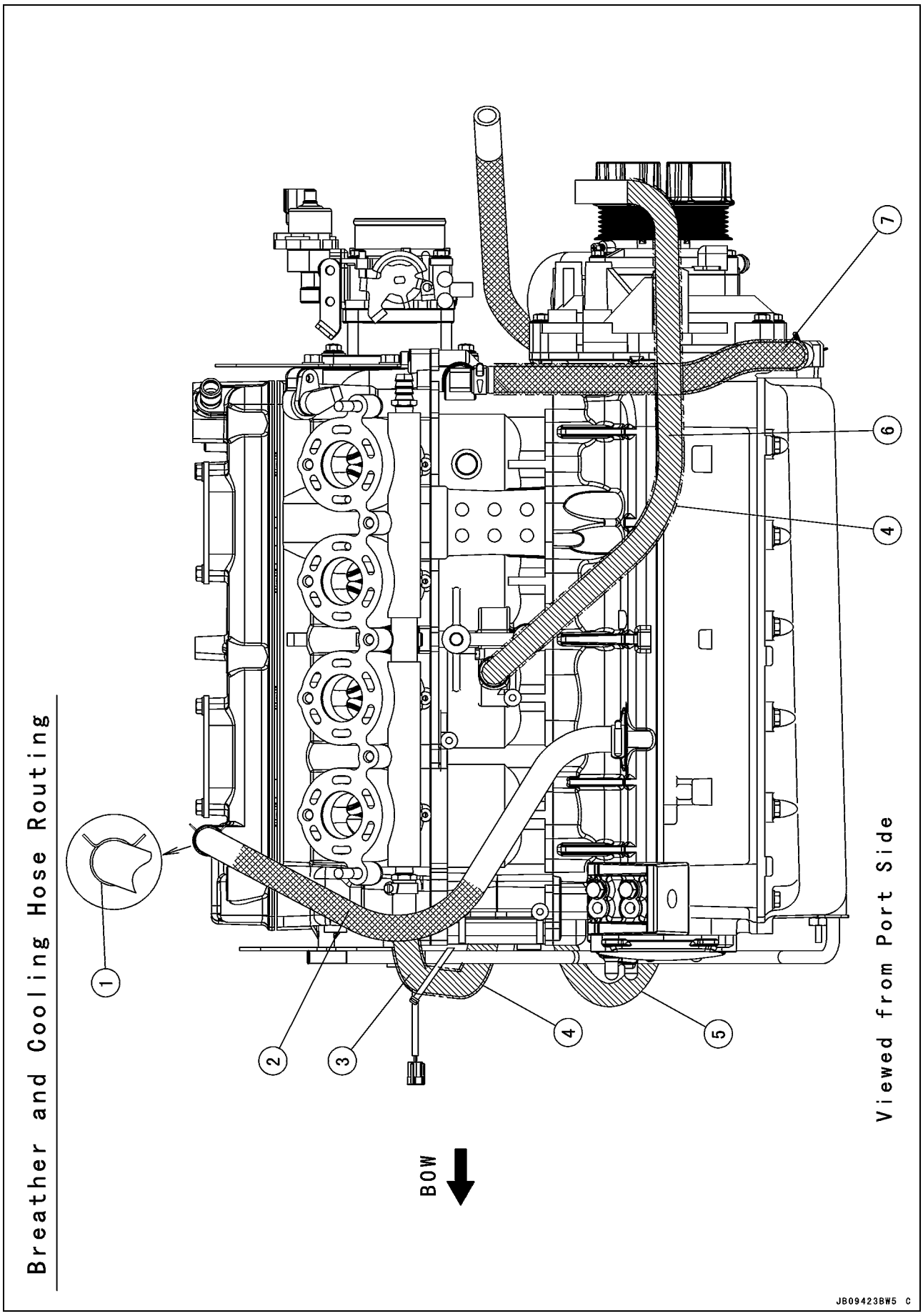


Cable, Wire and Hose Routing

1. Clamp
2. Breather Hose (Breather Case ~ Cylinder Head)
3. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
4. Protect Tube
5. Breather Case
6. Cooling Hose (Cylinder ~ Left Water Box Muffler)
7. Return Oil Hose (Cylinder ~ Breather Case)

Cable, Wire and Hose Routing

JT1500B8F

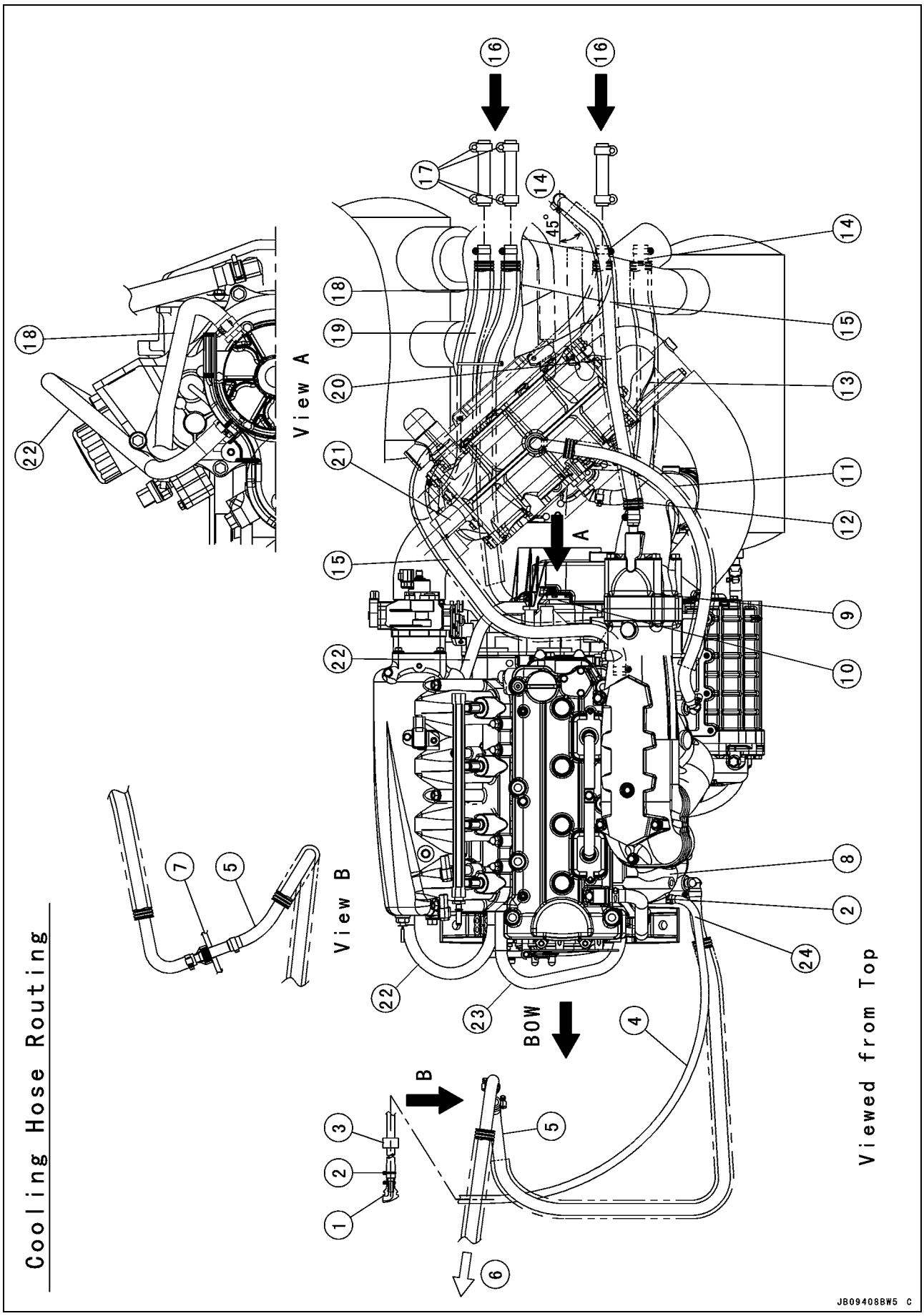


Cable, Wire and Hose Routing

1. Clamp
2. Breather Hose (Breather Case ~ Cylinder Head)
3. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
4. Protect Tube
5. Cooling Hose (Oil Cooler ~ Output Cover)
6. Cooling Hose (Cylinder ~ Left Water Box Muffler)
7. Return Oil Hose (Cylinder ~ Breather Case)

Cable, Wire and Hose Routing

JT1500B7F



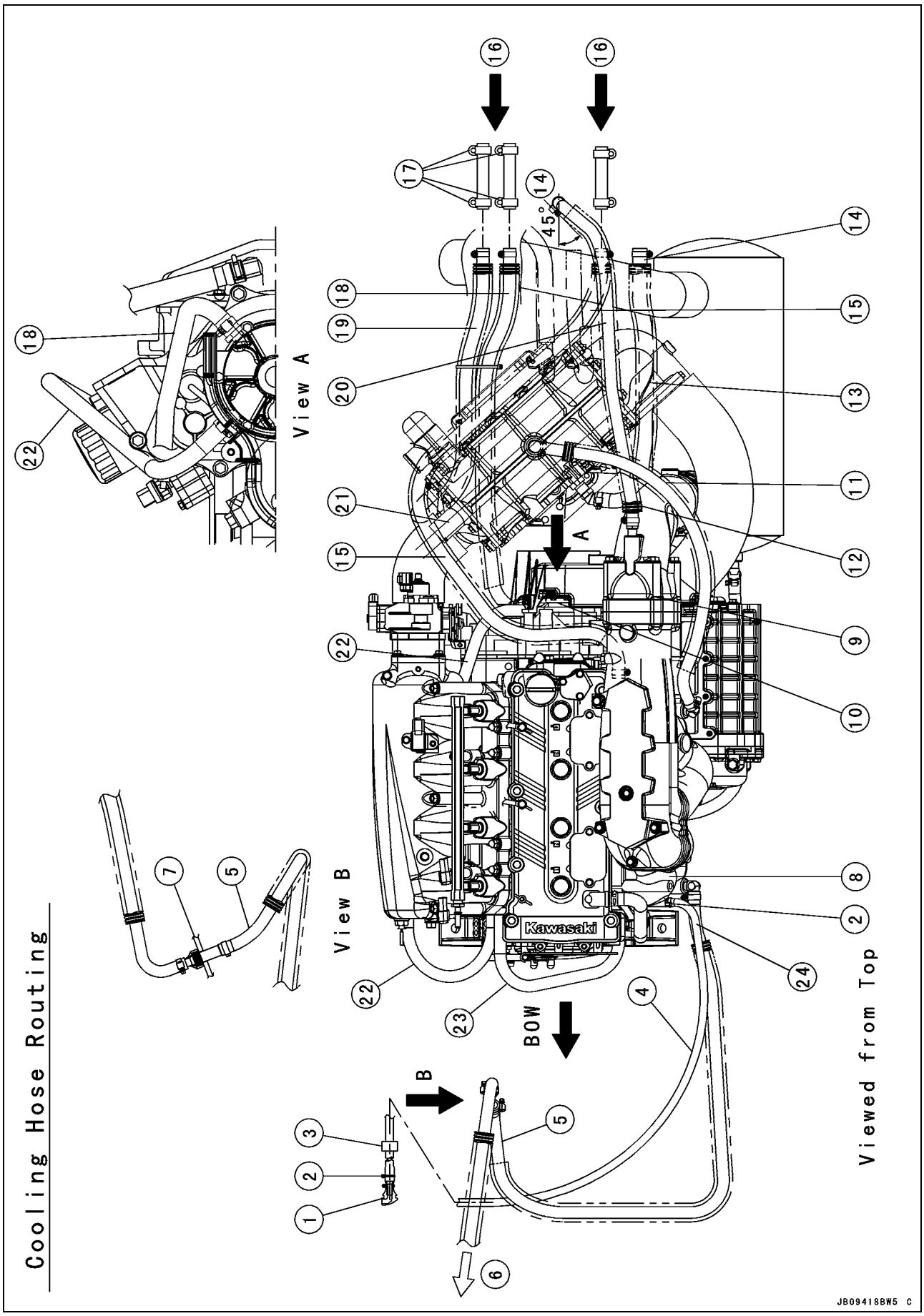
Cable, Wire and Hose Routing

Refer to the Exploded View and Flow Diagram in the Cooling and Bilge Systems chapter.
Install the clamp as shown, noting its screw head direction.

1. Bypass Outlet
2. Clamp
3. Holder
4. Bypass Outlet Hose
5. Flushing Hose
6. to Flushing Fitting
7. Deck
8. Exhaust Manifold
9. Muffler Body
10. Output Cover
11. Flushing Hose for Intercooler
12. Protect Tube
13. Cooling Hose (Intercooler ~ Hull)
14. Drain: Position the screw head, as shown.
15. Cooling Hose (Pump ~ Rear of Cylinder Head)
16. Pump
17. Position the clamp so that its screw head faces downward and outside.
18. Cooling Hose (Pump ~ Output Cover)
19. Cooling Hose (Pump ~ Intercooler)
20. Cooling Hose (Muffler Body ~ Hull): Run the cooling hose to the starboard side of bilge hose.
21. Intercooler
22. Cooling Hose (Output Cover ~ Oil Cooler)
23. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
24. L Shape Side

Cable, Wire and Hose Routing

JT1500B8F

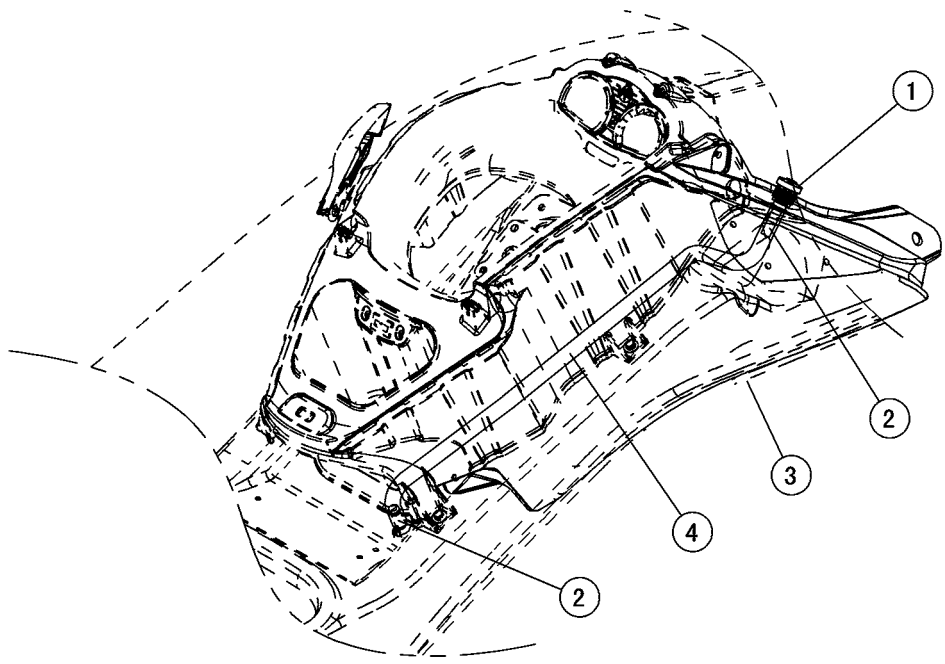


Cable, Wire and Hose Routing

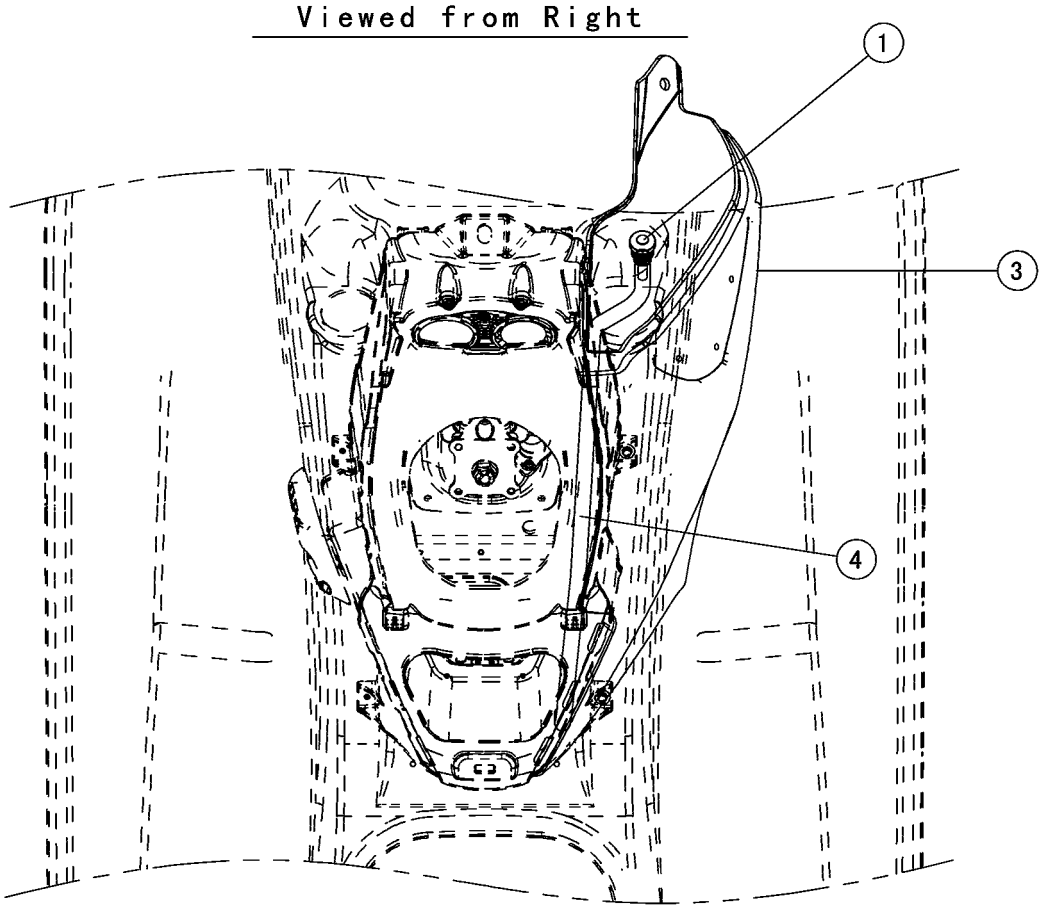
Refer to the Exploded View and Flow Diagram in the Cooling and Bilge Systems chapter.
Install the clamp as shown, noting its screw head direction.

1. Bypass Outlet
2. Clamp
3. Holder
4. Bypass Outlet Hose
5. Flushing Hose
6. to Flushing Fitting
7. Deck
8. Exhaust Manifold
9. Muffler Body
10. Output Cover
11. Flushing Hose for Intercooler
12. Protect Tube
13. Cooling Hose (Intercooler ~ Hull)
14. Drain: Position the screw head, as shown.
15. Cooling Hose (Pump ~ Rear of Cylinder Head)
16. Pump
17. Position the clamp so that its screw head faces downward and outside.
18. Cooling Hose (Pump ~ Output Cover)
19. Cooling Hose (Pump ~ Intercooler)
20. Cooling Hose (Muffler Body ~ Hull): Run the cooling hose to the starboard side of bilge hose.
21. Intercooler
22. Cooling Hose (Output Cover ~ Oil Cooler)
23. Cooling Hose (Oil Cooler ~ Front of Cylinder Head)
24. L Shape Side

Cable, Wire and Hose Routing



Viewed from Right



Viewed from Top

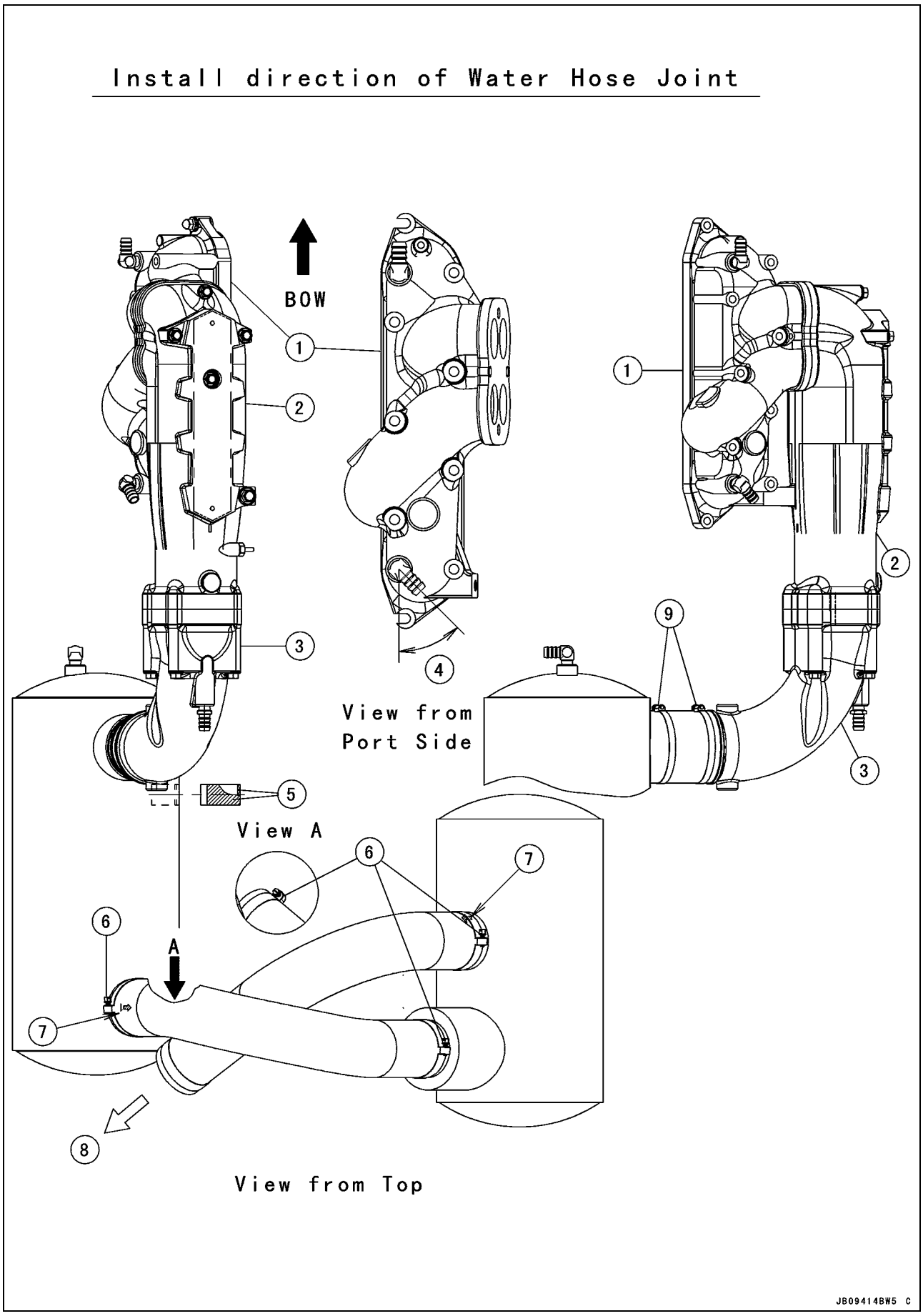
JB09321BW5 C

Cable, Wire and Hose Routing

1. Flushing Cap
2. Clamp
3. Right Side Cover
4. Flushing Line

Cable, Wire and Hose Routing

JT1500B7F

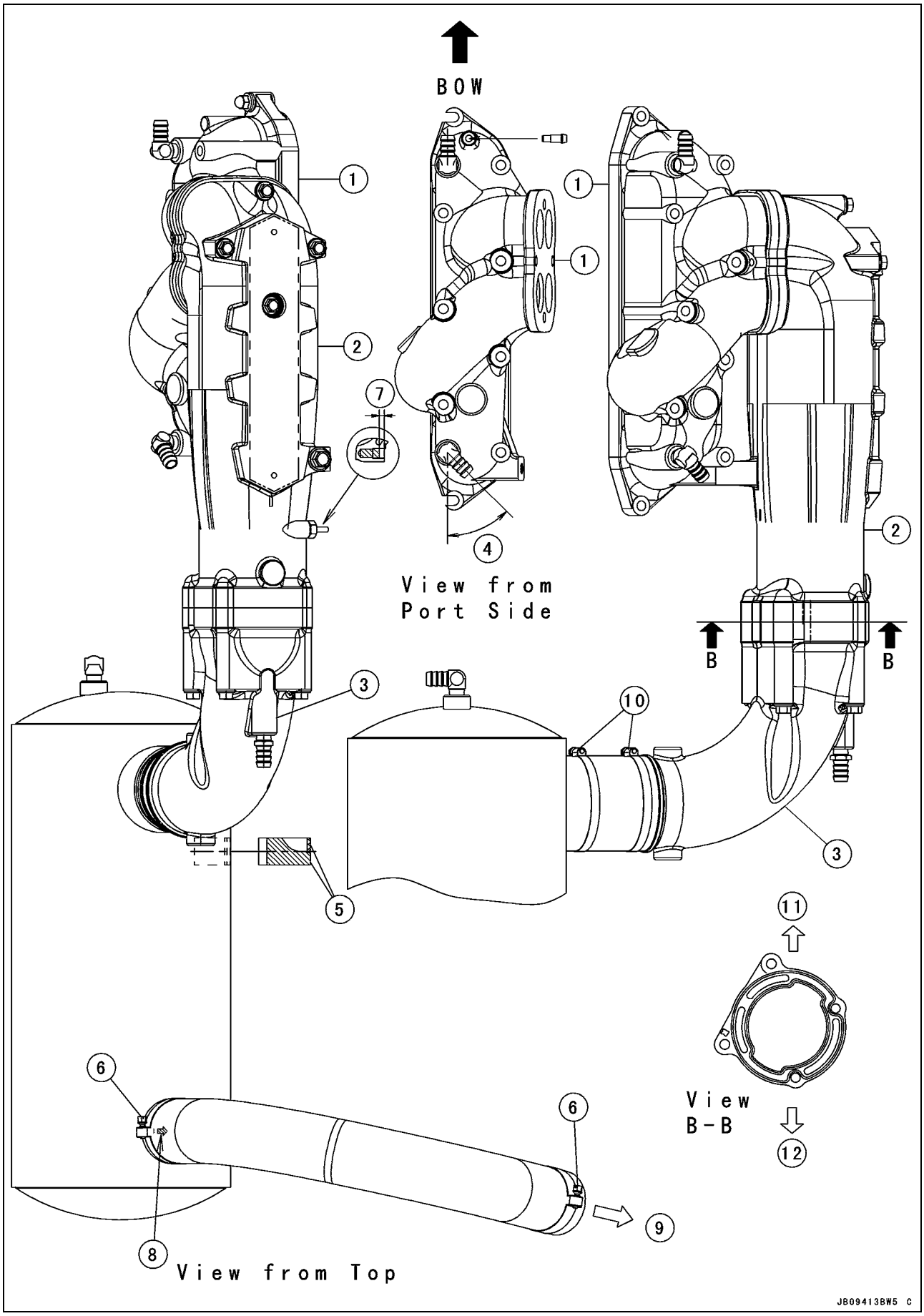


Cable, Wire and Hose Routing

1. Exhaust Manifold
2. Exhaust Pipe
3. Muffler Body
4. 45°
5. Dampers
6. Face forward.
7. Arrow Marks
8. to Tail Pipe
9. Face to starboard.

Cable, Wire and Hose Routing

JT1500B8F

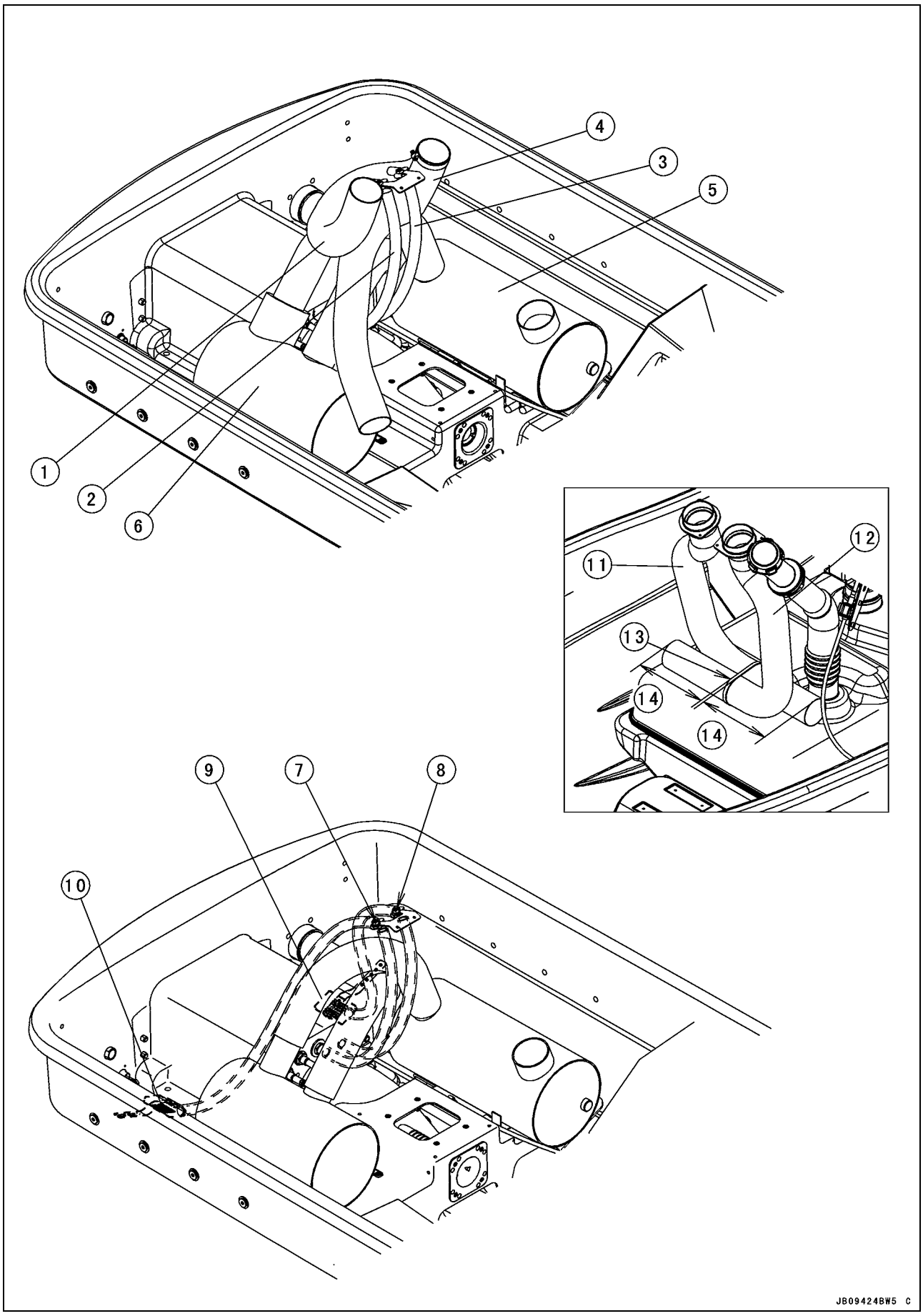


Cable, Wire and Hose Routing

1. Exhaust Manifold
2. Exhaust Pipe
3. Muffler Body
4. 45°
5. Dampers
6. Face forward.
7. 5 mm (0.2 in.)
8. Arrow Mark
9. to Tail Pipe
10. Face to starboard.
11. Port Side
12. Starboard Side

Cable, Wire and Hose Routing

JT1500B7F

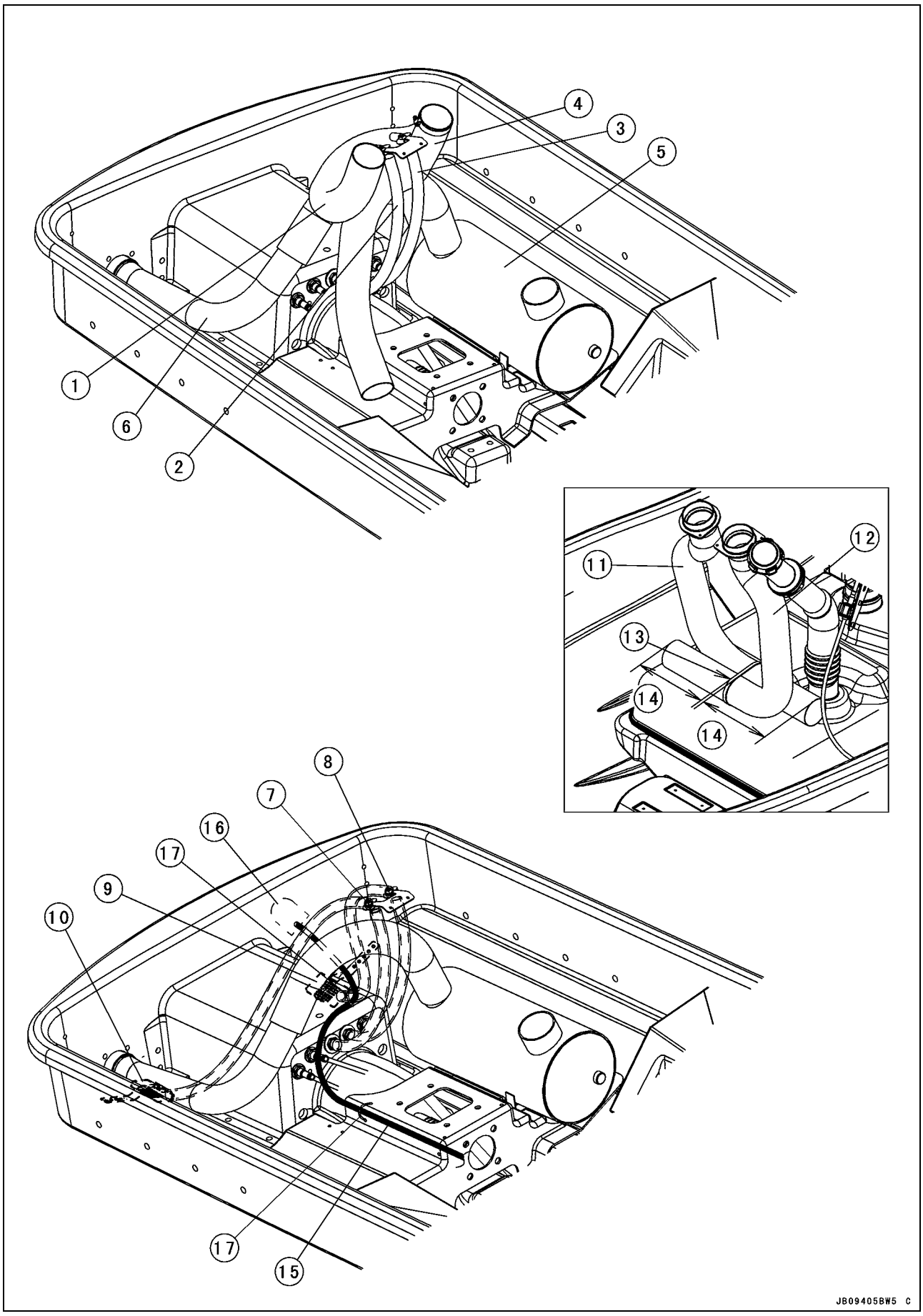


Cable, Wire and Hose Routing

1. Right Rear Duct
2. Right Bilge Hose
3. Left Bilge Hose
4. Left Rear Duct
5. Left Water Box Muffler
6. Right Water Box Muffler
7. Right Bilge Breather
8. Left Bilge Breather
9. Left Bilge Filter
10. Right Bilge Filter
11. Left Front Duct
12. Right Front Duct
13. Band
14. 150 mm (5.91 in.)

Cable, Wire and Hose Routing

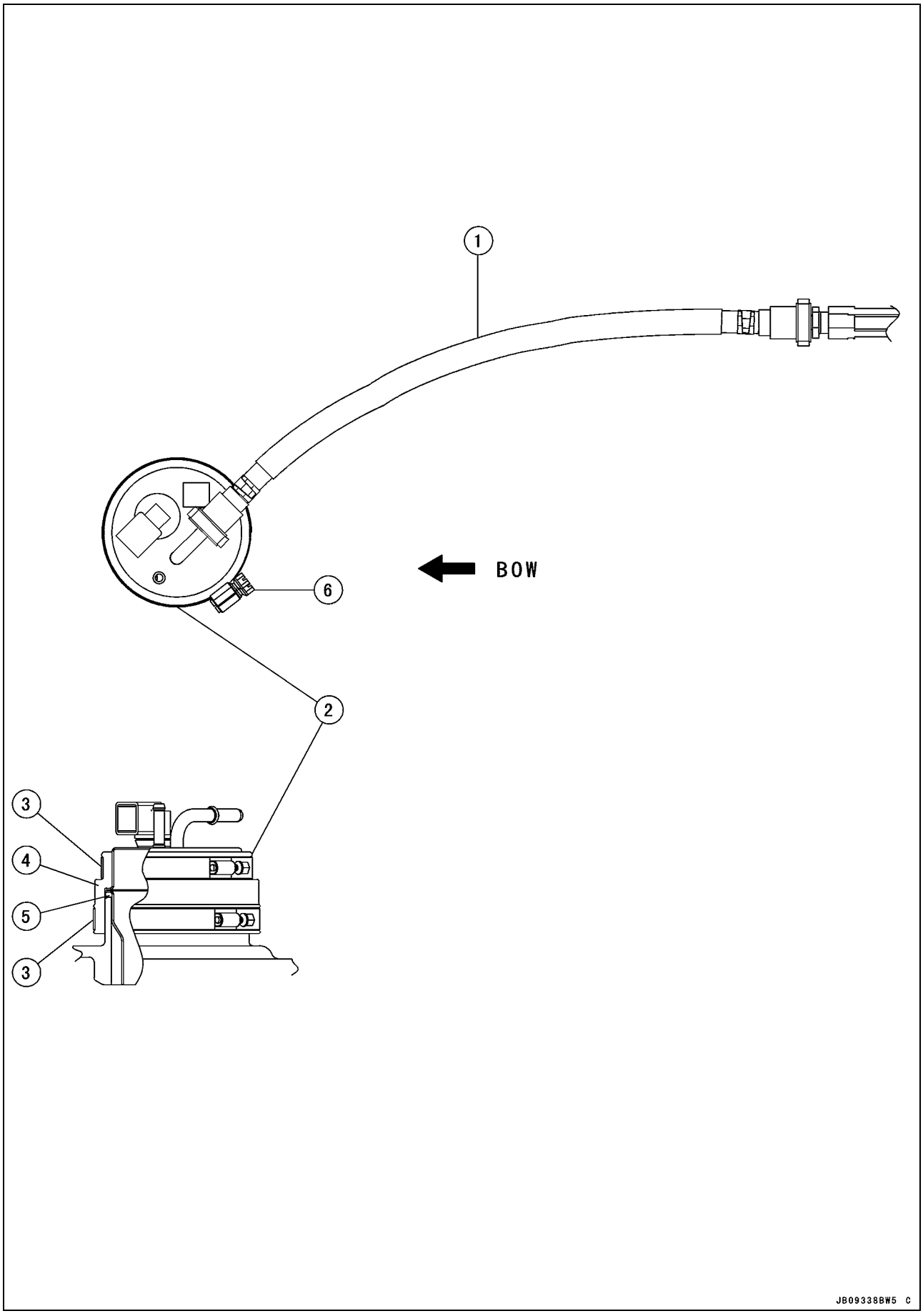
JT1500B8F



Cable, Wire and Hose Routing

1. Right Rear Duct
2. Right Bilge Hose
3. Left Bilge Hose
4. Left Rear Duct
5. Water Box Muffler
6. Tail Pipe
7. Right Bilge Breather
8. Left Bilge Breather
9. Left Bilge Filter
10. Right Bilge Filter
11. Left Front Duct
12. Right Front Duct
13. Band
14. 150 mm (5.91 in.)
15. Speed Sensor Lead
16. Speed Sensor
17. Bands

Cable, Wire and Hose Routing

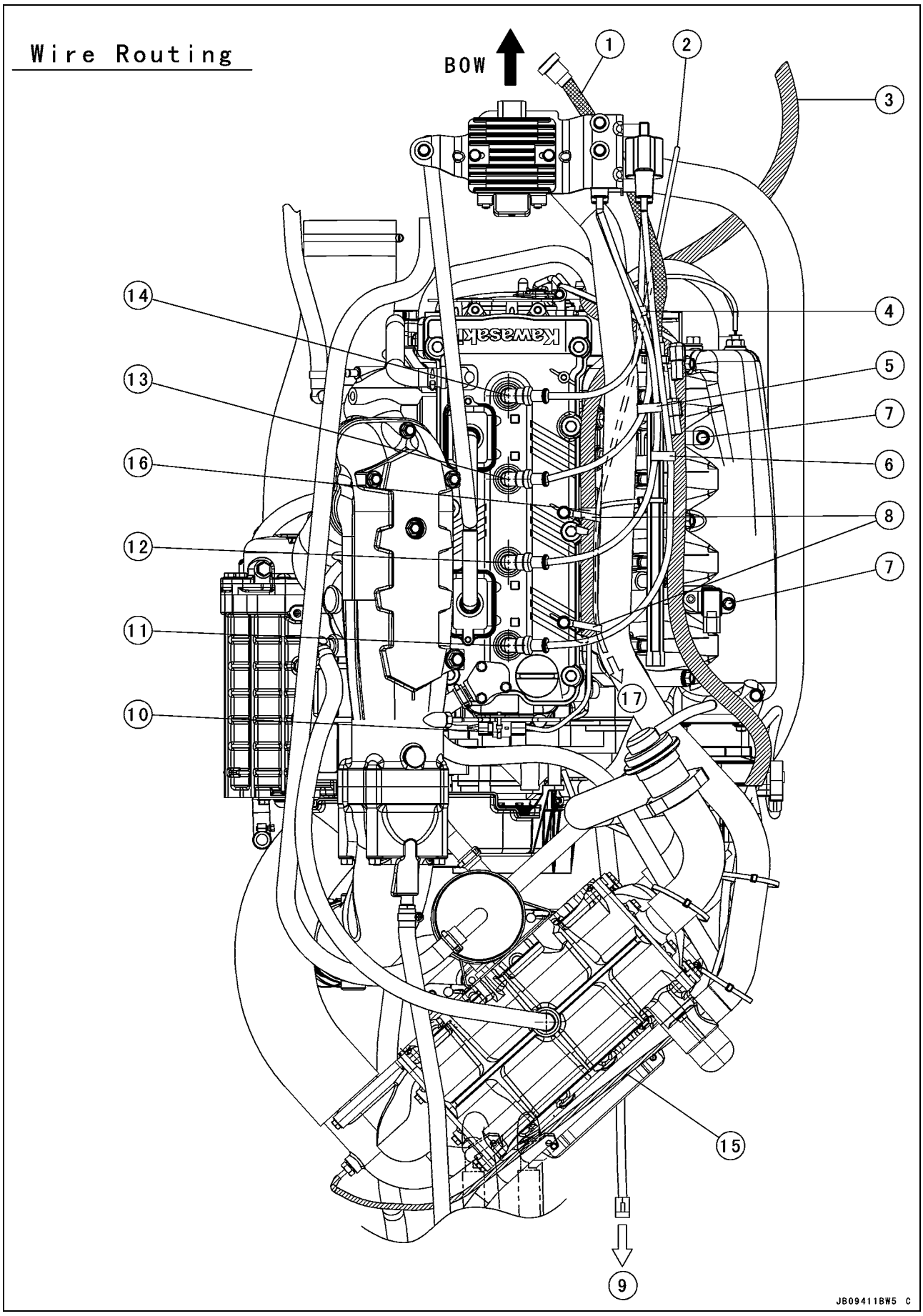


Cable, Wire and Hose Routing

1. Fuel Hose
2. Fuel Pump
3. Clamp
4. Holder
5. O-ring (JT1500B7F Model)
6. Install the clamp so that its screw position faces backwards.

Cable, Wire and Hose Routing

JT1500B7F

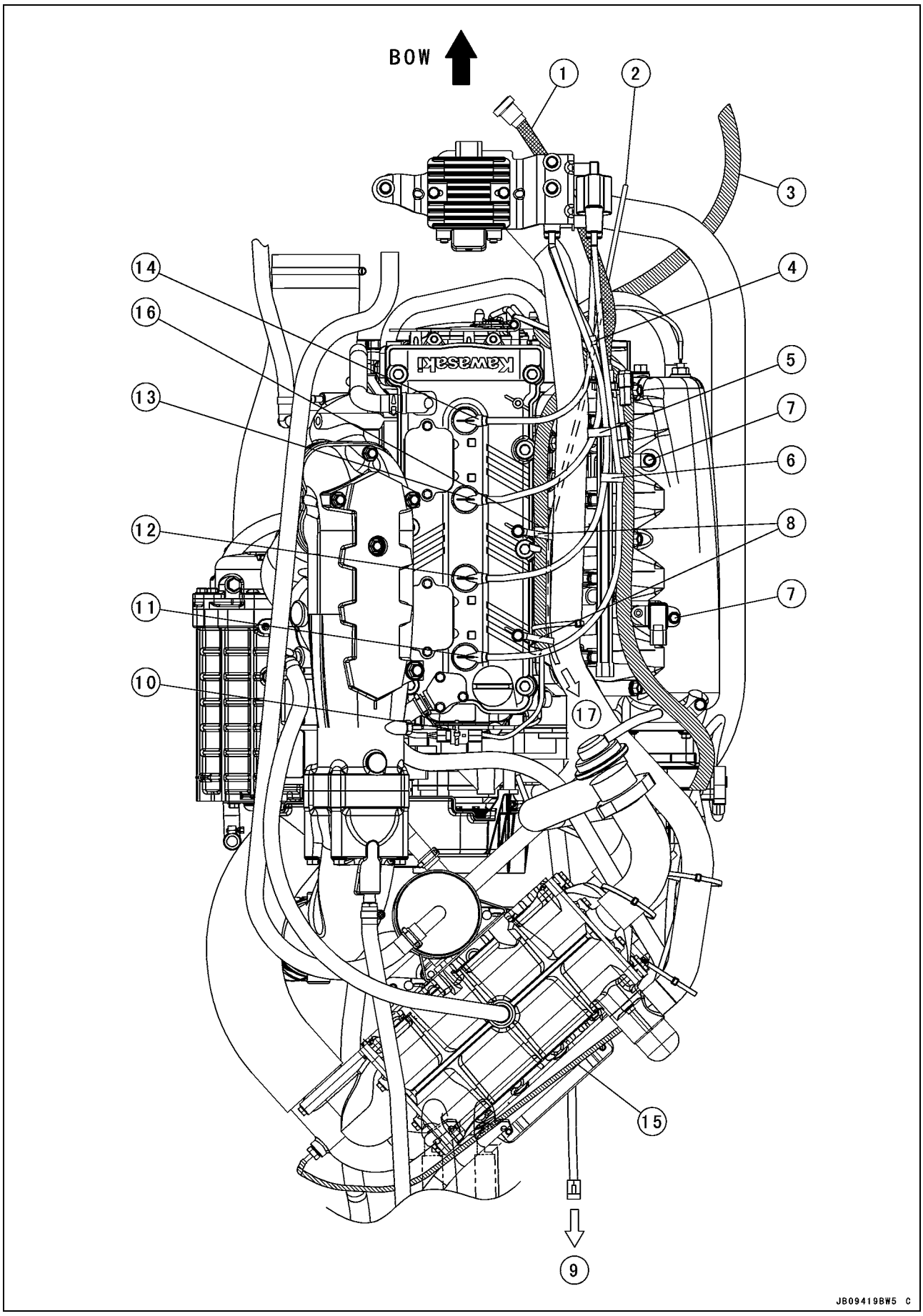


Cable, Wire and Hose Routing

1. Fuel Hose
2. Throttle Cable
3. Main Harness
4. Fix the #1 and #2 spark plug leads with the clamp.
5. Fix the #2 and #3 spark plug leads with the clamp.
6. Fix the #3 and #4 spark plug leads with the clamp.
7. Bolts
8. Fix the throttle cable and main harness with the clamp.
9. to Speed Sensor
10. Fix the camshaft position sensor connector and water temperature sensor leads with the band.
11. #4 Spark Plug Lead
12. #3 Spark Plug Lead
13. #2 Spark Plug Lead
14. #1 Spark Plug Lead
15. Run the charging temperature sensor lead between the front and rear bilge hoses.
16. White Tape
17. to Throttle Body Assy

Cable, Wire and Hose Routing

JT1500B8F

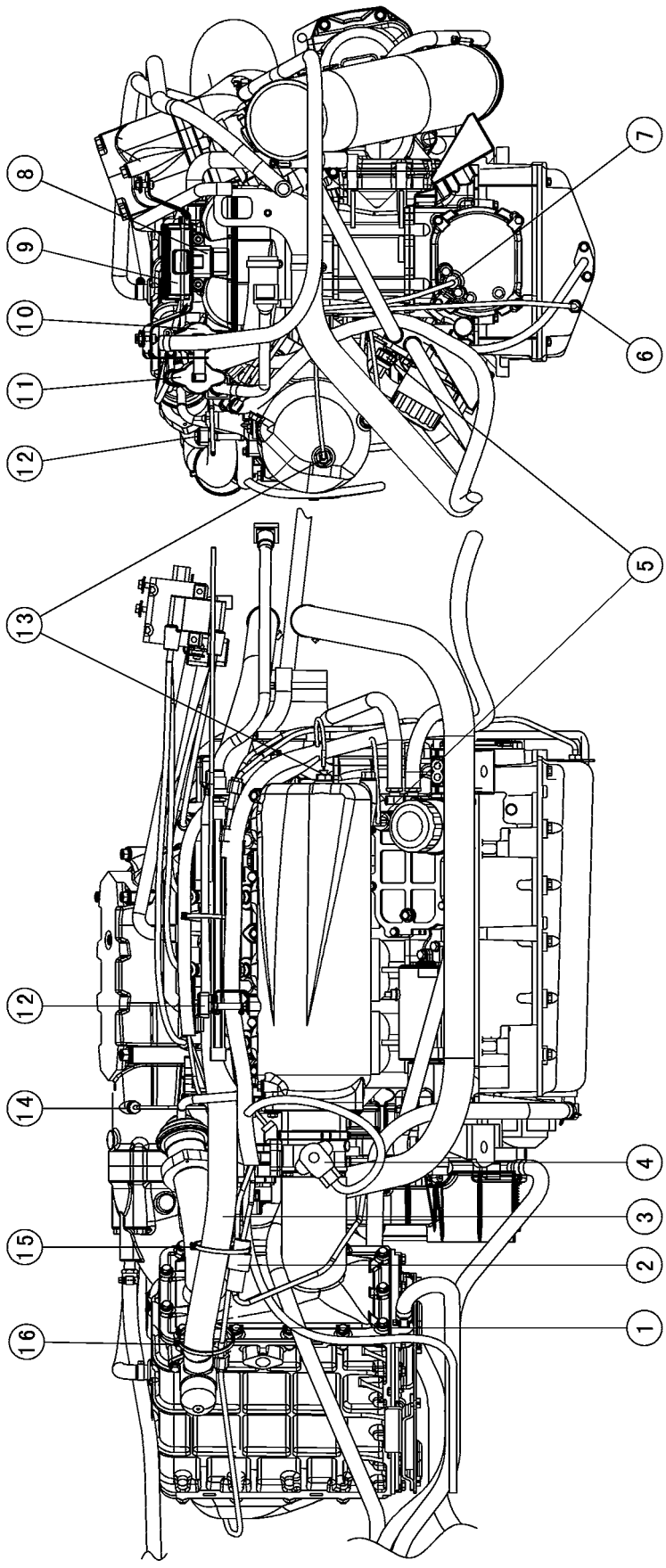


Cable, Wire and Hose Routing

1. Fuel Hose
2. Throttle Cable
3. Main Harness
4. Fix the #1 and #2 spark plug leads with the clamp.
5. Fix the #2 and #3 spark plug leads with the clamp.
6. Fix the #3 and #4 spark plug leads with the clamp.
7. Bolts
8. Fix the throttle cable and main harness with the clamp.
9. to Speed Sensor
10. Fix the camshaft positioned sensor connector and water temperature sensor leads with the band.
11. #4 spark plug lead must be positioned at a right angle to the engine center line.
12. #3 spark plug lead must be positioned at a right angle to the engine center line.
13. #2 spark plug lead must be positioned at a right angle to the engine center line.
14. #1 spark plug lead must be positioned at a right angle to the engine center line.
15. Run the charging temperature sensor lead between the front and rear bilge hoses.
16. White Tape
17. to Throttle Body Assy

Cable, Wire and Hose Routing

Wire Routing



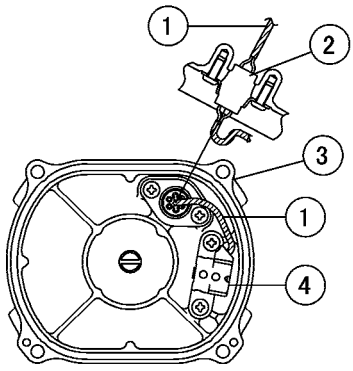
JB09412BW5 C

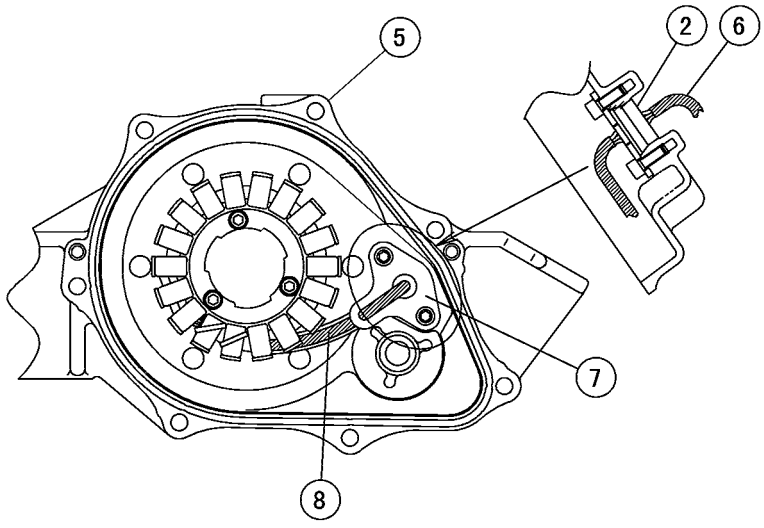
Cable, Wire and Hose Routing

1. Charging Temperature Sensor Leads
2. Stator Coil Leads Connector
3. Air Bypass Duct
4. Throttle Sensor
5. Oil Pressure Switch
6. Oil Temperature Sensor
7. Crankshaft Sensor
8. Vehicle-down Sensor
9. Regulator/Rectifier
10. #2, #3 Ignition Coil
11. #1, #4 Ignition Coil
12. Inlet Air Pressure Sensor
13. Inlet Air Temperature Sensor
14. Water Temperature Sensor
15. Fix the air bypass duct, the connector of stator coil leads and the leads of inlet air temperature sensor.
16. Fix the air bypass duct and inlet air temperature sensor lead with the band.

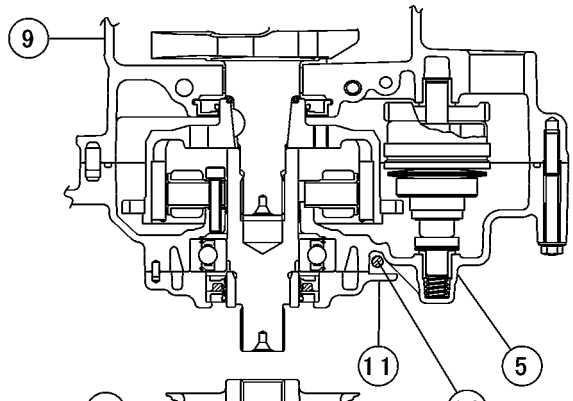
Cable, Wire and Hose Routing

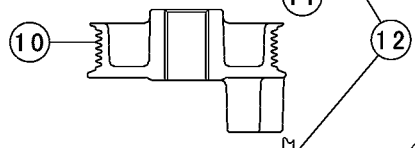
WIRE ROUTUNG AT CRANKSHAFT SENSOR AND MAGNETO COVER



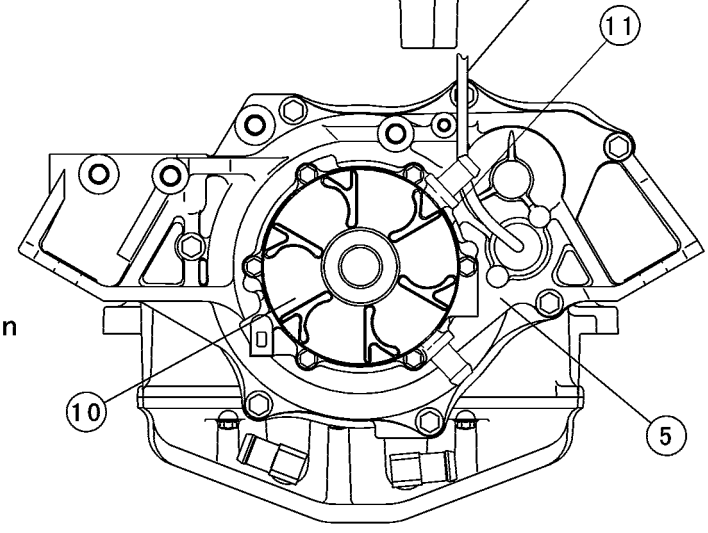


Viewed from Top





Viewed from Stern

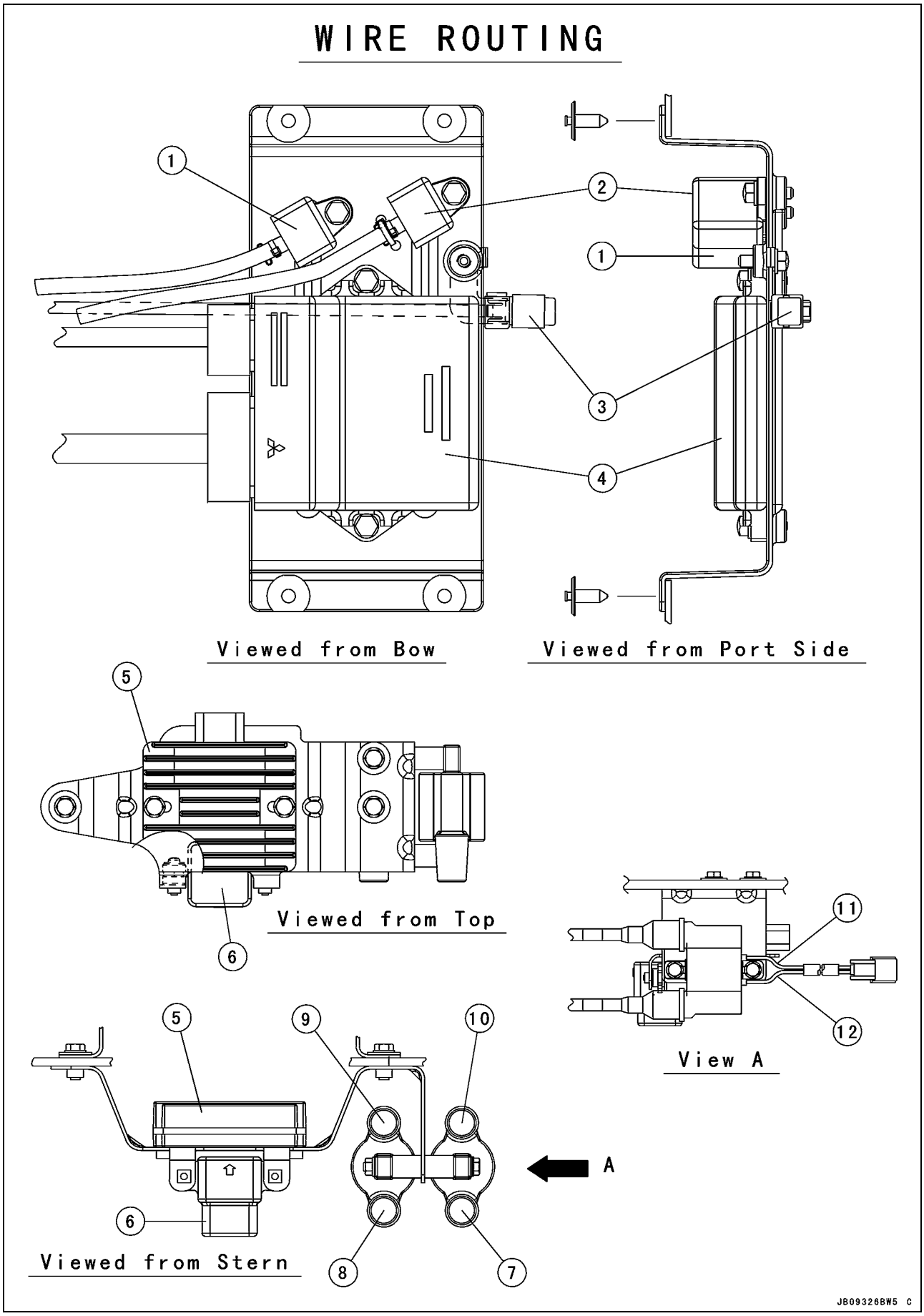


JB09341BW5 C

Cable, Wire and Hose Routing

1. Crankshaft Sensor Leads
2. Grommet
3. Crankshaft Sensor Cover (Reverse Side)
4. Crankshaft Sensor
5. Magneto Cover (Reverse Side)
6. Magneto Leads
7. Plate for fixing the magneto leads: Do not place the leads between the plate and magneto cover.
8. Run the magneto leads along the hollow of the magneto cover.
9. Crankcase
10. Coupling
11. Output Cover
12. Run the magneto leads between the magneto cover and output cover. Do not pinch the leads.

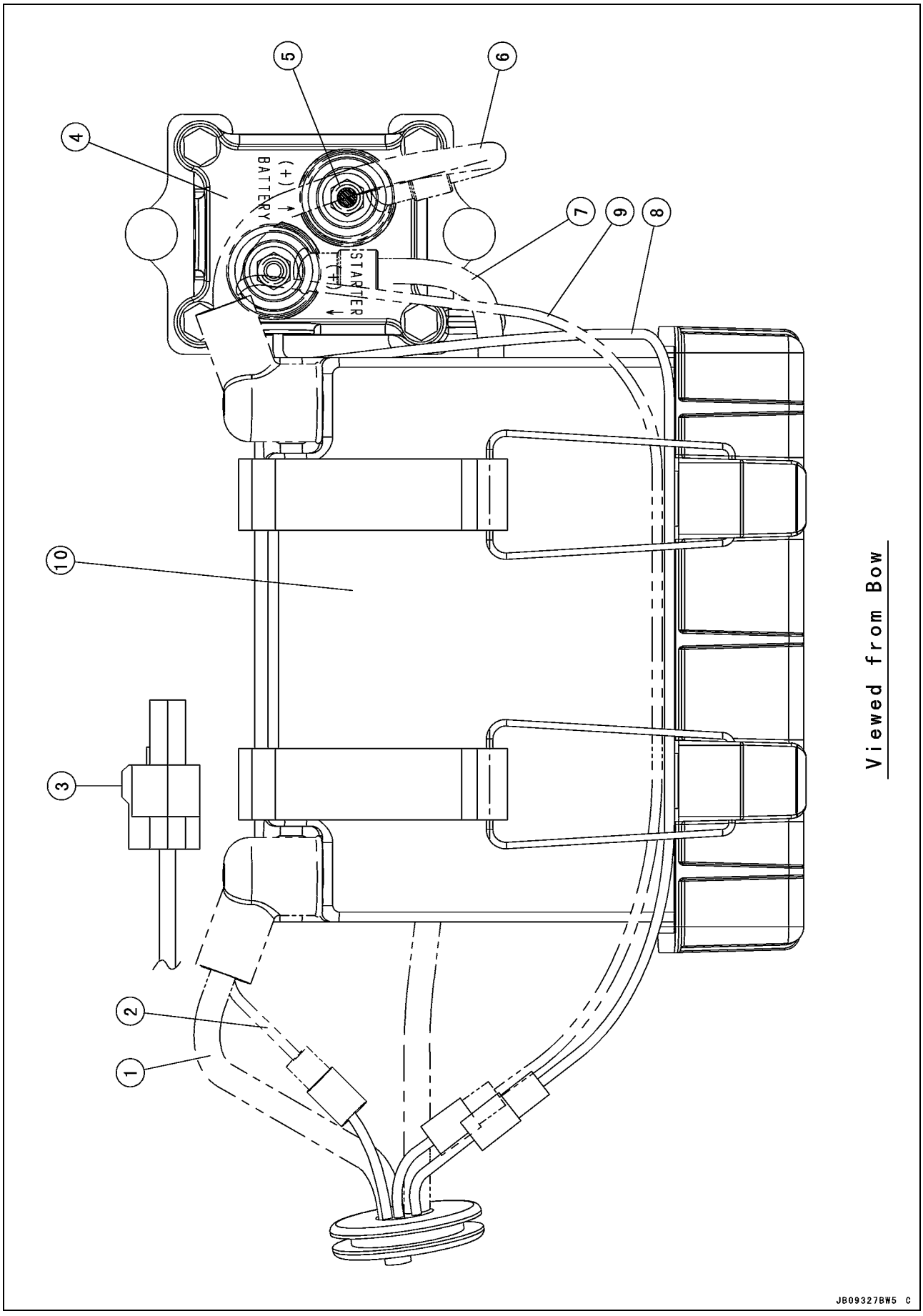
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Fuel Pump Relay
2. ECU Main Relay
3. 20 A Fuse
4. ECU
5. Regulator/Rectifier
6. Vehicle-down Sensor
7. #1 Ignition Coil
8. #2 Ignition Coil
9. #3 Ignition Coil
10. #4 Ignition Coil
11. Black Lead
12. Red Lead

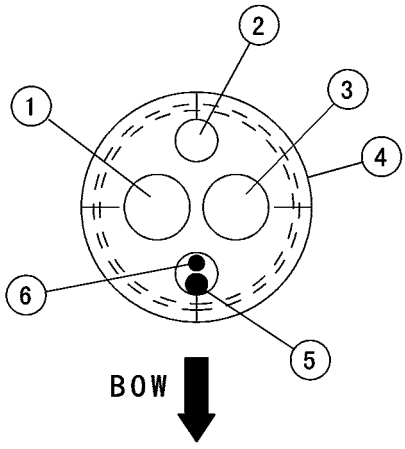
Cable, Wire and Hose Routing

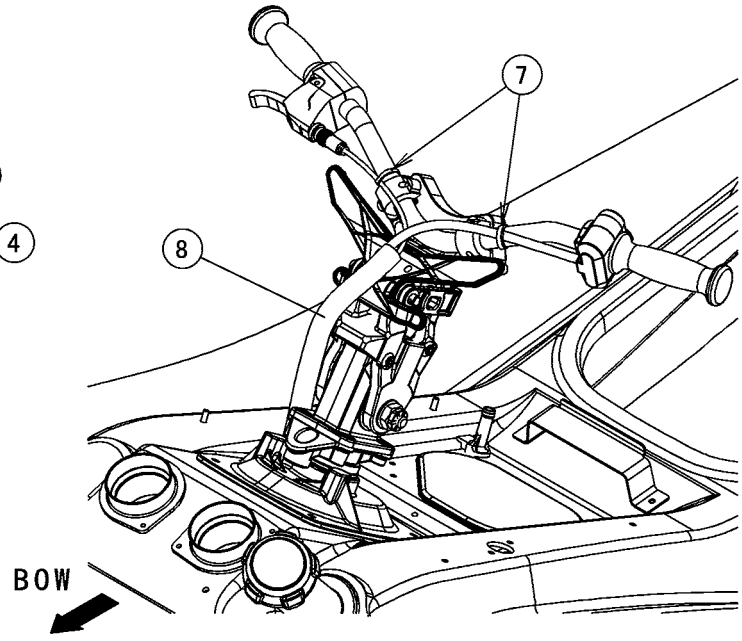


Cable, Wire and Hose Routing

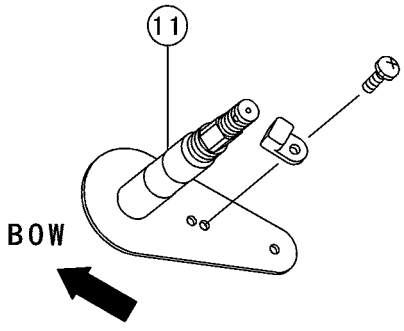
1. Battery (–) Cable
2. Battery (–) Lead
3. Connector for DIAG and Key Registration
4. Starter Relay
5. Red Mark
6. Battery (+) Cable
7. To Starter Motor
8. Starter Relay Leads
9. Battery (+) Lead
10. Battery

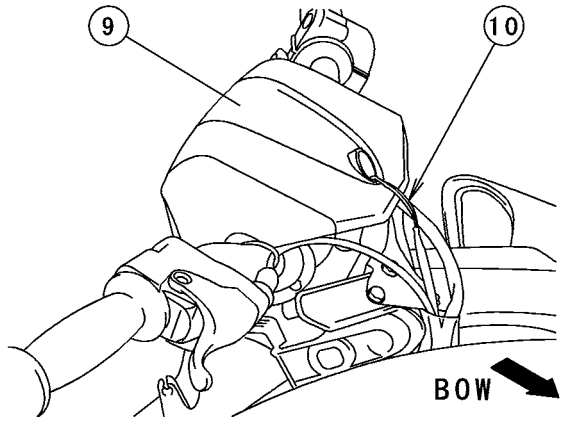
ROUTING AT HANDLEBAR

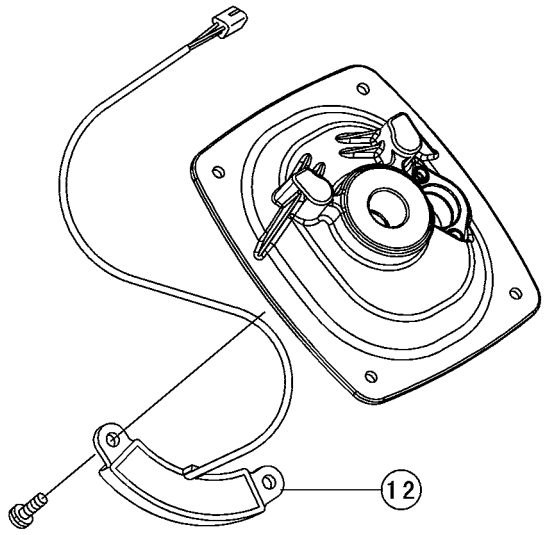


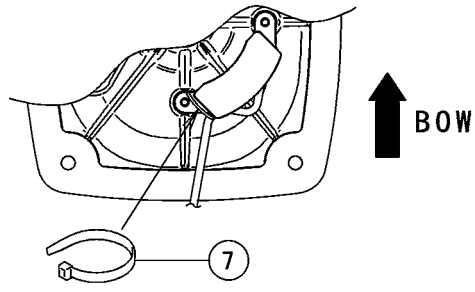


HOLDER LOCATION









JB09328BW5 C

Cable, Wire and Hose Routing

1. Fuel Vent Hose
2. Start/Stop Switch Leads
3. Multifunction Leads
4. Grommet
5. Throttle Cable
6. Buzzer Leads
7. Clamp
8. Protect Tube
9. Handlebar Pad
10. Buzzer Leads
11. Steering Shaft
12. Steering Position Sensor

Troubleshooting Guide

NOTE

○*This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

Engine Doesn't Start, Starting Difficulty

Starter motor not rotating
- Starter motor trouble (brushes worn)
- Battery voltage low
- Starter relay not contacting or operating
- Start button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown
- Immobilizer system trouble

Starter motor rotating but engine doesn't turn over
- Reduction gear trouble
- Vehicle-down sensor (DFI) coming off

Engine won't turn over
- Valve seizure
- Valve lifter seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Camshaft seizure

No fuel flow
- No fuel in tank
- Fuel tank air vent obstructed
- Fuel pump screen and/or fuel filter clogged
- Fuel injector trouble
- Fuel line clogged

Engine flooded
- Clean spark plug and adjust plug gap
- Starting technique faulty (When flooded, do not crank the engine with the throttle fully opened. This promotes engine flood because more fuel is supplied automatically by DFI.)

No spark; spark weak
- Ignition coil faulty
- Vehicle-down sensor (DFI) coming off
- Vehicle-down sensor trouble
- Ignition switch turned OFF and/or lanyard key not pushed under stop button
- Battery voltage low
- Spark plug dirty, broken, or gap maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- Spark plug cap trouble
- Spark plug cap shorted or not in good contact
- IC igniter in ECU trouble
- Camshaft position sensor trouble
- Crankshaft sensor trouble
- Wiring shorted or open
- Fuse blown

Fuel/air mixture incorrect
- Air passage clogged
- Air filter poorly sealed
- Air bypass system (relief valve, blow off valve) malfunction

Troubleshooting Guide

Fuel injector trouble
Water or foreign matter in fuel
Throttle sensor trouble
Fuel pressure may be low
Fuel pump trouble
Inlet air pressure sensor trouble
Inlet air temperature sensor trouble
Water temperature sensor trouble
Crankshaft sensor trouble

Compression Low
Spark plug loose
Cylinder head not sufficiently tightened down
No valve clearance
Cylinder, piston worn
Piston ring bad (worn, weak, broken, or sticking)
Piston ring/groove clearance excessive
Cylinder head gasket damaged
Cylinder head warped
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Poor Running at Low Speed

Spark weak
Battery voltage low
Spark plug dirty, broken, or maladjusted
Ignition coil shorted or not in good contact
Ignition coil trouble
Spark plug incorrect
Spark plug cap trouble
Spark plug cap shorted or not in good contact
IC igniter in ECU trouble
Camshaft position sensor trouble
Crankshaft sensor trouble

Fuel/air mixture incorrect
Air passage clogged
Air filter poorly sealed
Air bypass system (relief valve, blow off valve) malfunction
Fuel tank air vent obstructed
Fuel pump trouble
Inlet air duct loose
Fuel pump screen and/or fuel filter clogged
Throttle body assy loose
Throttle body assy gasket damage
Fuel line clogged
Inlet air pressure sensor trouble
Inlet air temperature sensor trouble

Engine stalls easily
Fuel pump trouble
Fuel injector trouble
Throttle sensor trouble
Camshaft position sensor trouble
Fuel pressure too low or too high
Inlet air pressure sensor trouble
Water temperature sensor trouble
Inlet air temperature sensor trouble
Fuel line clogged
Crankshaft sensor trouble

Ignition coil trouble

Compression low
Spark plug loose
Cylinder head not sufficiently tightened down
No valve clearance
Cylinder, piston worn
Piston ring bad (worn, weak, broken, or sticking)
Piston ring/groove clearance excessive
Cylinder head warped
Cylinder head gasket damaged
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Hesitation
Too low fuel pressure
Clogged fuel line
Fuel pump trouble
Fuel injector trouble
Inlet air temperature sensor trouble
Throttle sensor trouble
Water temperature sensor trouble
Inlet air pressure sensor trouble
Loose injector connectors
Crankshaft sensor trouble
Ignition coil trouble
Loose terminal of battery (–) lead or engine ground lead

Poor acceleration
Too low fuel pressure
Water or foreign matter in fuel
Clogged fuel filter or pump screen
Fuel pump trouble
Fuel injector trouble
Inlet air temperature sensor trouble
Water temperature sensor trouble
Ignition coil trouble
Engine oil level to high
Spark plug dirty, broken or gap maladjusted
Supercharger malfunction (belt trouble, duct leakage)

Stumble
Too low fuel pressure
Fuel injector trouble
Throttle sensor malfunction
Water temperature sensor trouble
Inlet air pressure sensor trouble

Surge
Unstable fuel pressure
Fuel injector trouble
Water temperature sensor trouble

Backfiring when deceleration
Spark plug dirty, broken or gap maladjusted
Too low fuel pressure
Fuel pump trouble
Throttle sensor trouble
Inlet air temperature sensor trouble
Water temperature sensor trouble
Inlet air pressure sensor trouble
Air suction valve trouble

Troubleshooting Guide

After fire
- Crankshaft sensor trouble
- Spark plug burned or gap maladjusted
- Inlet air temperature sensor trouble
- Water temperature sensor trouble
- Inlet air pressure sensor trouble
- Fuel injector trouble

Run-on (dieseling)
- Ignition switch trouble
- Engine switch trouble
- Fuel injector trouble
- Loose terminal of battery (–) lead or ECU ground lead
- Carbon accumulating on valve seating surface
- Engine overheating

Other
- IC igniter in ECU trouble
- Engine oil viscosity too high
- Air suction valve trouble
- Engine overheating
- Intermittent any DFI fault and its recovery

Poor Running or No Power at High Speed

Firing incorrect
- Spark plug dirty, broken, or maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- Spark plug cap trouble
- Spark plug cap shorted not in good contact
- Camshaft position trouble
- IC igniter in ECU trouble
- Crankshaft sensor trouble

Fuel/air mixture incorrect
- Air filter poorly sealed
- Air filter O-ring damaged
- Inlet air duct loose
- Water or foreign matter in fuel
- Fuel to injector insufficient (DFI)
- Fuel tank air vent obstructed
- Fuel line clogged
- Fuel pump trouble (DFI)
- Injector clogged
- Throttle body assy loose
- Throttle body assy gasket damaged
- Fuel line clogged
- Fuel pump operates intermittently
- Inlet air temperature sensor trouble
- Throttle sensor trouble
- Inlet air pressure sensor trouble

Compression low
- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged

Cylinder head warped
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)

Knocking
Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
IC igniter in ECU trouble
Camshaft position sensor trouble
Crankshaft sensor trouble
Ignition coil trouble
Inlet air temperature sensor trouble

Miscellaneous
Throttle valve won't fully open
Engine overheating
Engine oil level too high
Engine oil viscosity too high
Air suction valve trouble
Camshaft cam worn

Overheating

Firing incorrect
Spark plug dirty, broken, or maladjusted
Spark plug incorrect
IC igniter in ECU trouble

Fuel/air mixture incorrect
Inlet air duct loose
Air filter poorly sealed
Air filter O-ring damaged

Compression high
Carbon built up in combustion chamber

Engine load faulty
Engine oil level too high
Engine oil viscosity too high

Lubrication inadequate
Engine oil level too low
Engine oil poor quality or incorrect

Oil cooler incorrect
Oil cooler clogged

Sensor incorrect
Water temperature sensor broken

Over Cooling

Sensor incorrect
Water temperature sensor broken

Abnormal Engine Noise

Knocking
IC igniter in ECU trouble
Carbon built up in combustion chamber
Fuel poor quality or incorrect
Spark plug incorrect
Overheating

Piston slap
Cylinder/piston clearance excessive
Cylinder, piston worn

Troubleshooting Guide

Connecting rod bent
Piston pin, piston pin hole worn

Valve noise
Valve clearance incorrect
Valve spring broken or weak
Camshaft bearing worn
Valve lifter worn

Other noise
Connecting rod small end clearance excessive
Connecting rod big end clearance excessive
Piston ring/groove clearance excessive
Piston ring worn, broken, or stuck
Piston ring groove worn
Piston seizure, damage
Cylinder head gasket leaking
Crankshaft runout excessive
Engine mount loose
Crankshaft bearing worn
Camshaft chain tensioner trouble
Camshaft chain, sprocket, guide worn
Air suction valve damaged
Magneto flywheel loose

Oil Pressure Warning Light Goes On

Oil pump damaged
Oil screen clogged
Oil filter clogged
Engine oil level too low
Engine oil viscosity too low
Camshaft bearing worn
Crankshaft bearing worn
Oil pressure switch damaged
Wiring faulty
O-ring at the oil passage in the crankcase damaged

Battery Trouble

Battery discharged
Charge insufficient
Battery faulty (too low terminal voltage)
Battery lead making poor contact
Magneto trouble
Wiring faulty
Regulator/rectifier trouble

Battery overcharged
Magneto trouble
Regulator/rectifier trouble
Battery faulty

Poor Performance through Engine Runs Properly

Jet pump
Intake area obstructed
Impeller or pump case damaged
Excessive clearance between impeller and pump case

Troubleshooting Guide

Poor Steering Control (Since faulty steering is dangerous, this problem should be examined by an authorized Jet Ski dealer)

Handlebar hard to turn
- Steering maladjusted
- Bushing damaged or cracked
- Steering shaft bent
- No lubricant on steering pivot
- Steering cable damaged or improperly routed

Engine Activates Slow Down Mode

Cooling water temperature gets high
- Weeds or debris in jet pump
- Cooling water line clogged

Low oil pressure
- Low oil level
- Improper engine oil quality

Water temperature sensors malfunction, wiring open or short

Vehicle-down sensor malfunction, wiring open or short

Oil temperature sensor gets high
- Low oil level
- Oil pump malfunction
- Relief valve malfunction
- Weeds or debris in jet pump
- Cooling water line clogged

Oil temperature sensor malfunction, wiring open or short

Charging temperature gets high
- Cooling water line clogged
- Charging temperature sensor trouble
- Impeller or pump case damaged
- Intercooler clogged
- Air bypass valve trouble

MODEL APPLICATION

Year	Model	Beginning Hull No.
2007	JT1500B7F	US-KAW30001□607 US-KAW39001□607
2008	JT1500B8F	US-KAW40001□708 US-KAW49001□708

□:This digit in the hull number changes from one machine to another.

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Consumer Products & Machinery Company

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